SECTION 17.
RF INPUT MODULE (A17)

17.1 DESCRIPTION

The RF Input module comprises four sections:

1) the Wattmeter board (A17A1),
2) the Wideband Amplifier board (A17A2),
3) the Duplex Generator board (A17A3), and
4) the mechanical assembly.

The chassis uses feed-through filters and capacitors to interconnect the three printed circuit boards. The mechanical assembly includes a 0 to 130-dB rotary step attenuator with associated co-axial cables, Antenna, RF In/Out and Duplex Generator ports, and the Duplex Generator On/Off switch.

Electrically, the RF Input module provides five primary RF functions:

1) High-level generate (GENERATE ANTENNA PORT) provides an RF-output signal (AM,FM, or CW; 10 kHz to 1 GHz) adjustable over a range of +13 dBm to −135 dBm;
2) Low-level generate (GENERATOR RF IN/OUT PORT) provides an RF-output signal (as above, for GENERATE ANTENNA PORT), adjustable over a range of −17 dBm to −165 dBm;
3) High-level power monitor (MONITOR RF IN/OUT PORT) provides a means of measuring RF power (1 MHz to 1 GHz; 1 to 125W at ±10 percent accuracy);
4) Sensitive monitor (MONITOR ANTENNA PORT) provides off-the-air reception;
5) Duplex Generator (DUPLEX GEN) provides an RF-output signal, offset in frequency (0 to 10 MHz or fixed 45 MHz) from the received signal.

A wirelist of the RF Input module is shown at the end of the section in Table 17-2, a block diagram in Figure 17-1, and an interconnect diagram in Figure 17-2. Following that, Figure 17-3 coordinates a parts list with the assembly of the RF Input module and with the printed wiring board assembly of the RF Input Flex Standard.

17.2 THEORY OF OPERATION

17.2.1 WATTMETER BOARD (A17A1)

17.2.1.1 General

RF power to and from the System Analyzer passes through the Wattmeter board to one of two ports, Antenna or RF In/Out. In the sensitive monitor mode (less than 100 milliwatts) or in high-level generate mode, the signal is either transmitted or received through the Antenna port. In the high-level RF-input mode, power enters the module through the RF In/Out port. This port is −30 dB below the Antenna port. This board also contains the circuitry for the wattmeter.

A block diagram of the Wattmeter board is shown at the end of the section in Figure 17-4, a schematic in Figure 17-5 and the printed wiring board assembly and parts list in Figure 17-6.

17.2.1.2 Wattmeter

In the monitor-RF-power mode, the signal applied to the RF In/Out port (J1) is first attenuated by a 14-dB, 125W attenuator (AT2). This reduced power level is applied to 50-ohm load AT3. Diode CR1 detects the peak of the voltage produced across the load, and the resulting dc level is applied to a three-stage, instrumentation-style amplifier (U1A, U1B, and U1C).

Thermistor RT2 compensates for changes in the internal temperature of the compartment. Diode CR3 and operational amplifier U1A provide temperature compensation for diode CR1. U1B amplifies the detected signal, and then U1C differentially sums U1B's output with the output of the reference amplifier, U1A. The signal at the output of U1C is connected to the Scope/DVM Control board (A7), where it is routed to the DVM. Because of diode detector CR1, this output is directly proportional to the square root of the power applied (Power in watts = $1.25*V^2$). Potentiometer R20 provides offset adjustment, while R7 provides gain adjustment. For 125W of input power, 50-ohm load AT3 dissipates only 5W, with the balance absorbed by the 14-dB, 125W attenuator, AT2.

17.2.1.3 Over-Temperature Protection

The 14-dB, 125W attenuator (AT2) can dissipate 125 watts for approximately 1.5 minutes, at which time the temperature of the device exceeds the temperature rating of 100°C. Thermistor RT1, recessed into the flange that AT2 is soldered to, decreases in resistance to 10K ohm, causing the output of comparator U2A to go high. This signal causes the processor to activate the System Analyzer's audible alarm and to flash a warning signal on the CRT until the applied RF power is removed and AT2 has had ample time to cool off.

17.2.1.4 Port Selection

The Antenna and RF In/Out port signal is routed to the Wideband Amplifier board (A17A2) by relay K1. The Antenna port is selected by turning on transistor Q1. This path starts at the connector, passes through fuse F1 and relay K1, connecting to the Wideband Amplifier via the rotary step attenuator, AT1. Following loads AT2 and AT3, the RF In/Out port is similarly connected to the Wideband Amplifier via rotary step attenuator AT1. Both the Antenna and RF In/Out port can receive and transmit signals from the Wideband Amplifier.

17.2.2 WIDEBAND AMPLIFIER BOARD (A17A2)

17.2.2.1 General

The Wideband Amplifier board performs three functions: 1) amplification and leveling of the RF Synthesizer's output; 2) RF-switching, which allows the RF Synthesizer's output to be used as the system's RF-generator output or as the local oscillator (L.O.) for the system's monitor function; and 3) frequency-translation, converting the RF input to 10.7 MHz when the system is in monitor mode.

A block diagram of the Wideband Amplifier board is shown at the end of the section in Figure 17-7, a schematic in Figure 17-8, and a printed wiring board assembly and parts list in Figure 17-9.

17.2.2.2 Generate Mode

When the system's FUNCTION control is set to Generate FM, Generate CW, Generate AM, or SWP, or when the DISPLAY control is set to Spect Analyzer, the MON + DSB/GEN input is low, putting the Wideband Amplifier in generate mode. In this mode, the Wideband Amplifier's output is directed through relay K1 and out the ATTENUATOR OUT/IN port. The RF-leveling loop allows control of the level of the RF output. Using the variable RF Level control on the front panel, the operator can vary the level at the Antenna port between −3 dBm and +13 dBm.

17.2.2.2.1 Voltage-Controlled Attenuator (VCA)

The RF Synthesizer's (A9) output drive to amplifier U4 is controlled by the VCA (Q2, CR1, CR2, CR3). As the voltage on the base of Q2 is varied, the currents through PIN diodes CR1, CR2, and CR3 are changed, thus varying the attenuation. Minimum attenuation occurs when the voltage on the base of Q2 is at its maximum (approximately 11 volts). Over the full range of dc control voltages, the VCA range is greater than 50 dB.

17.2.2.2.2 Wideband Amplifiers

The VCA is followed by three stages of amplifi tion at U4, U5, and Q7. This cascade has a nominal ga of about 35 dB and can linearly deliver +16 dBm to a 50-ohm load. U4 and U5 are biased with constant current sources Q4 and Q5, respectively. Q7 is biased in a slightly different manner by Q6. Q6 samples the collector current of Q7 and adjusts the base bias accordingly, to achieve a collector current of 57 mA.

17.2.2.2.3 Detector and Detector Amplifier

The output voltage of the Wideband Amplifier is sampled by detector CR10. Accuracy at low output levels is improved by slightly forward-biasing CR10 with resistors R29-R31 and R33. Operational amplifier U7 amplifies the detector output and drives the CARRIER + MOD LVL output and one input of the summing amplifier. The CARRIER + MOD LVL output is used to measure the output level and percent AM of the signal at the generator output. Gain potentiometer R34 and offset potentiometer R38 are adjusted so that the CARRIER + MOD LVL is 8 times the rms voltage at the output of the front panel's Antenna port.

17.2.2.2.4 Summing Amplifier and ALC-Reference Selection

As mentioned in the previous paragraph, one input of the summing amplifier, U8, is driven by the detector amplifier. The other input is driven by the ALC-reference selector, U9. The summing amplifier compares the detector amplifier's output with the selected ALC reference and then adjusts the VCA's drive to correspond to the desired output level indicated by the ALC-reference voltage. In generate mode, the AM MOD + DC REF input is selected as the ALC reference. When AM is not the selected function, this signal is a dc voltage, controlled by the variable RF Level control on the front panel. The range of this voltage is sufficient to allow an output-power range of −3 dBm to +13 dBm at the front panel's Antenna port. When AM is the selected function, the AM MOD + DC REF input consists of ac and dc components. The ratio of the ac component to the dc component determines the percent AM at the generator output. This ratio and the type of modulation signal are controlled by the front panel's MODULATION controls.

17.2.2.2.5 HI/LO Band Switching

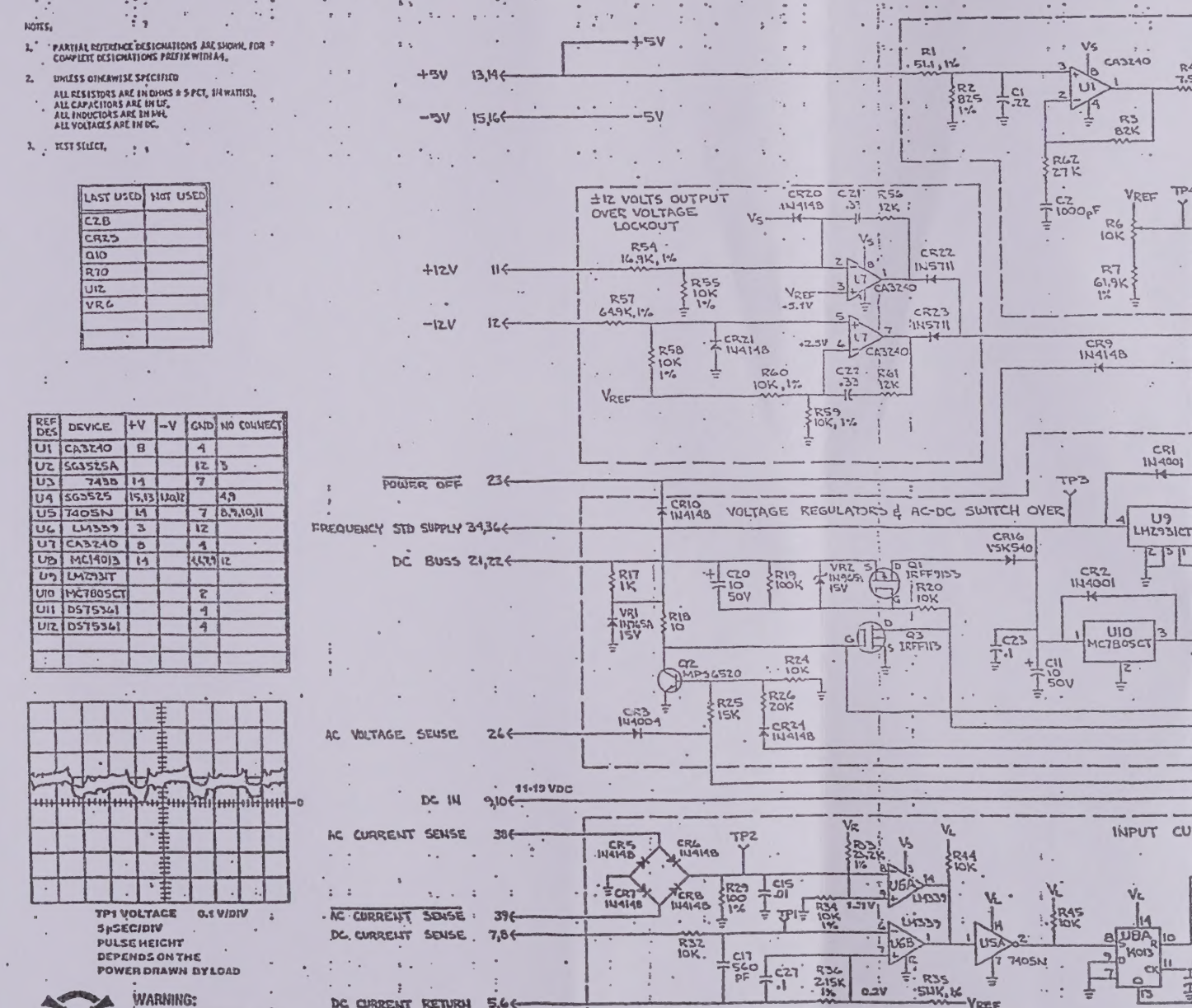
To operate over the full band of 10 kHz to 1 GHz, the Wideband Amplifier is operated in either HI-band mode or LO-band mode. The mode is controlled by the WB AMP HI/LO input. In HI-band mode, the VCA

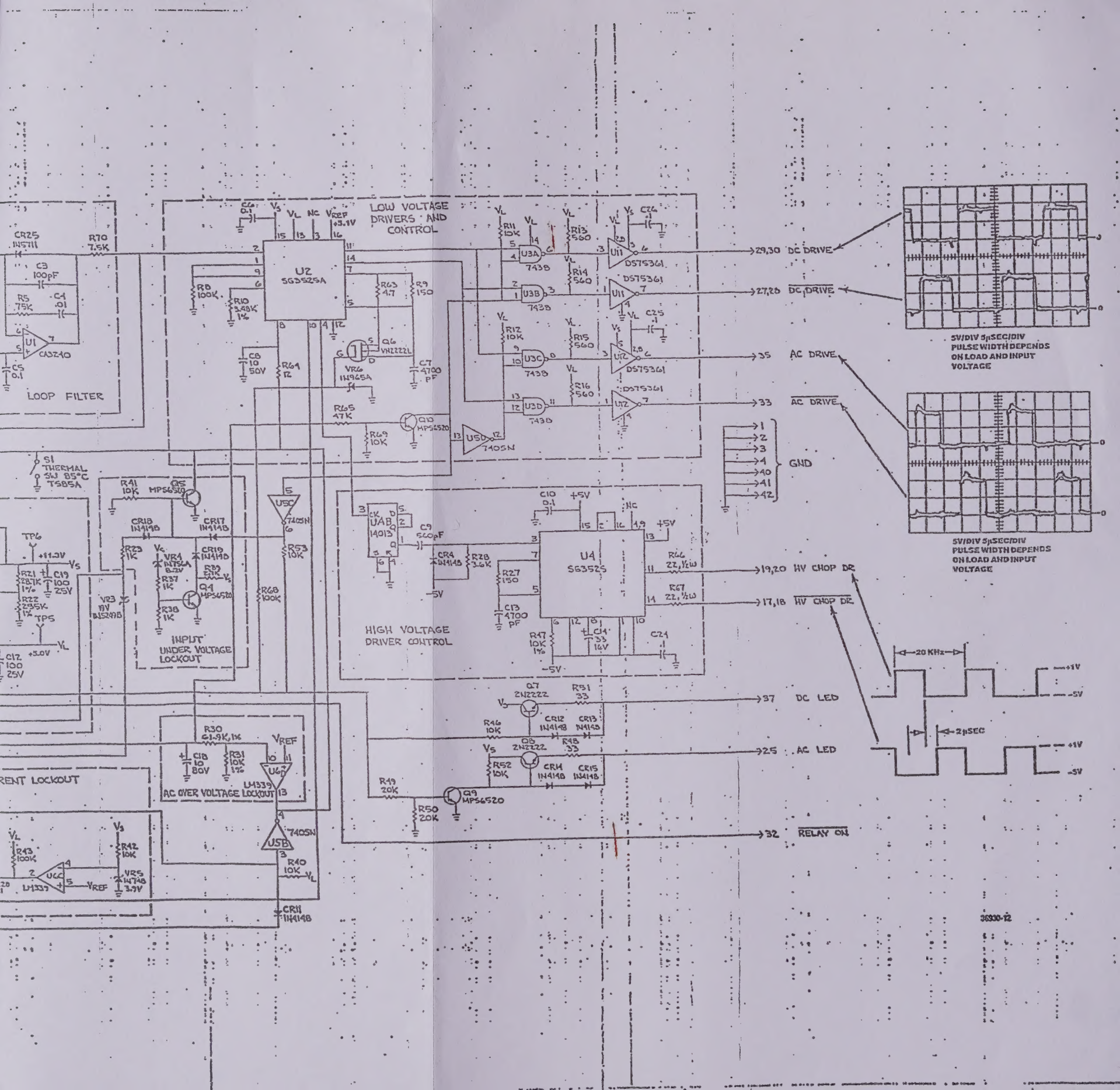
LOW VOLTAGE POWER SUPPLY

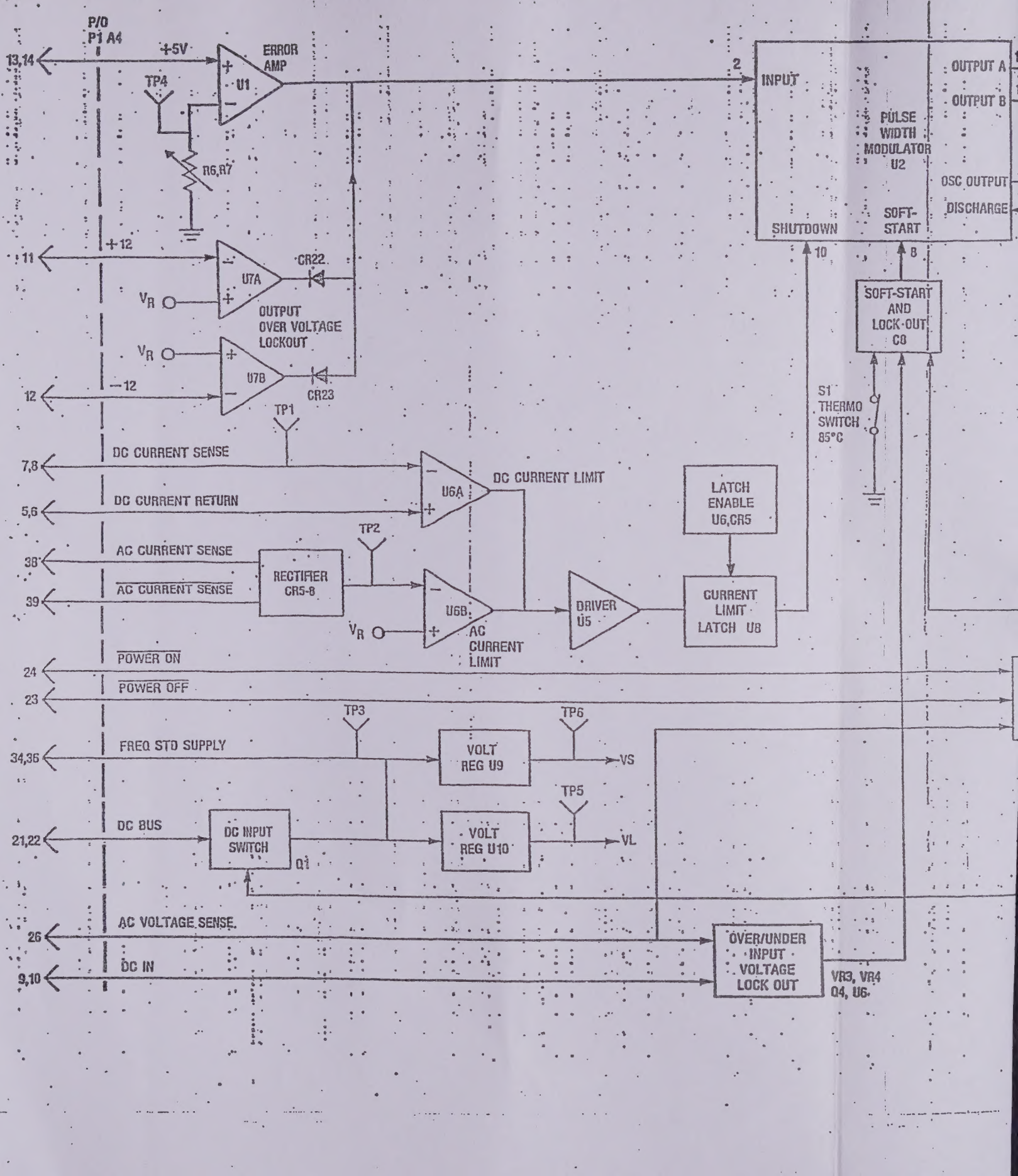
CONTROL BOARD (A4)

(RTP-1009A)

Figure 8-6. Schematic



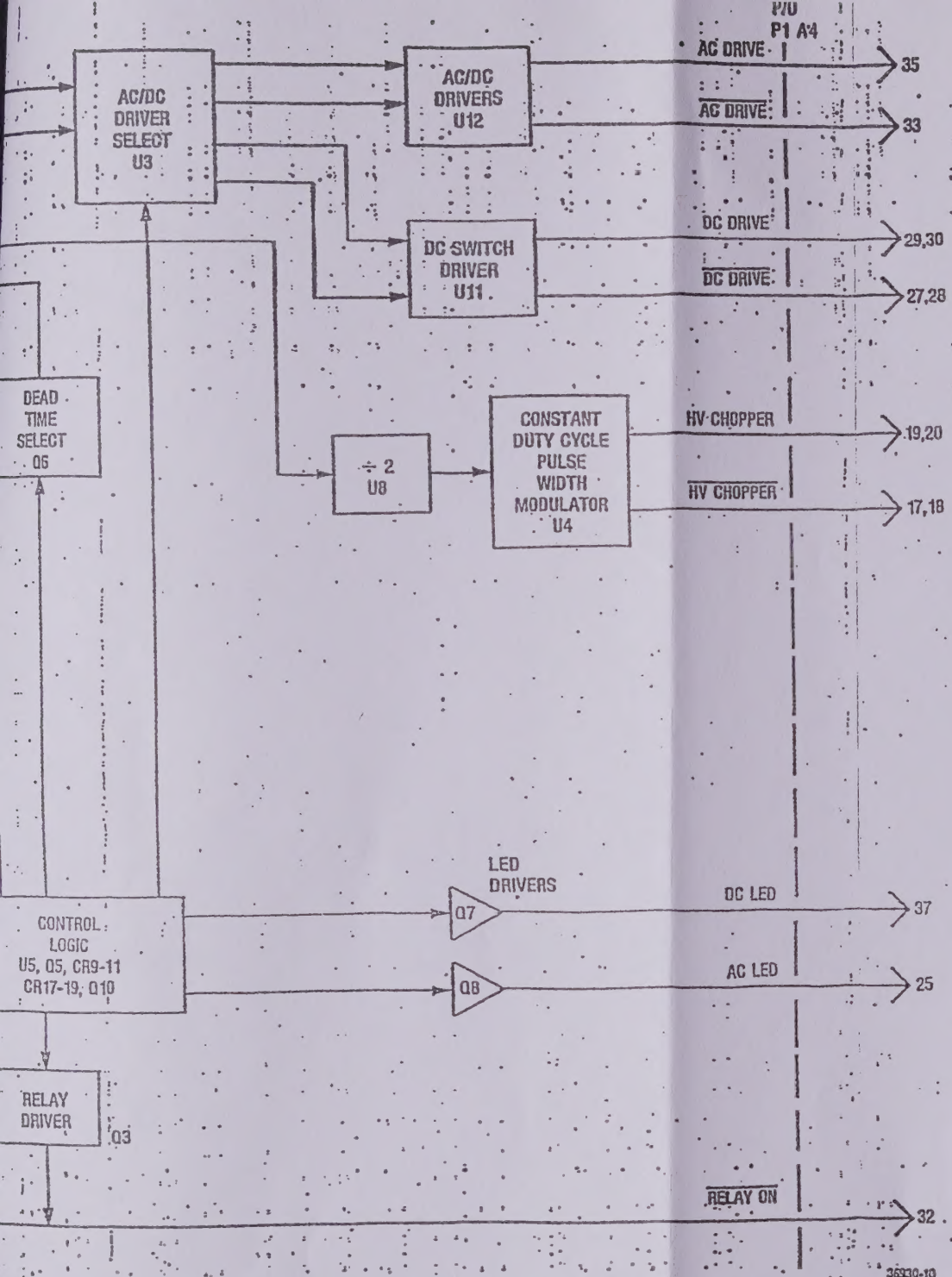

LOW VOLTAGE DRIVERS AND CONTROL
LOOP FILTER
INPUT UNDER VOLTAGE LOCKOUT
HIGH VOLTAGE DRIVER CONTROL
AC OVER VOLTAGE LOCKOUT
29,30 DC DRIVE
27,28 DC DRIVE
35 AC DRIVE
33 AC DRIVE
GND
19,20 HV CHOP DR
17,18 HV CHOP DR
37 DC LED
25 AC LED
32 RELAY ON
5V/DIV 5μSEC/DIV PULSE WIDTH DEPENDS ON LOAD AND INPUT VOLTAGE
5V/DIV 5μSEC/DIV PULSE WIDTH DEPENDS ON LOAD AND INPUT VOLTAGE
20 KHz
2μSEC
+1V
-5V
36930-12


P/O
P1 A4
13,14
+5V
ERROR
AMP
U1
TP4
R6,R7
2
INPUT
PULSE
WIDTH
MODULATOR
U2
OUTPUT A
OUTPUT B
OSC OUTPUT
DISCHARGE
SHUTDOWN
SOFT-
START
10
8
+12
11
U7A
CR22
VR
OUTPUT
OVER VOLTAGE
LOCKOUT
SOFT-START
AND
LOCK-OUT
C8
VR
U7B
12
−12
CR23
S1
THERMO
SWITCH
85°C
TP1
DC CURRENT SENSE
7,8
U6A
DC CURRENT LIMIT
DC CURRENT RETURN
5,6
LATCH
ENABLE
U6,CR5
TP2
AC CURRENT SENSE
38
RECTIFIER
CR5-8
AC CURRENT SENSE
39
U6B
DRIVER
U5
CURRENT
LIMIT
LATCH U8
VR
AC
CURRENT
LIMIT
POWER ON
24
POWER OFF
23
TP3
TP6
FREQ STD SUPPLY
34,36
VOLT
REG U9
VS
TP5
DC BUS
21,22
DC INPUT
SWITCH
Q1
VOLT
REG U10
VL
AC VOLTAGE SENSE
26
DC IN
9,10
OVER/UNDER
INPUT
VOLTAGE
LOCK OUT
VR3, VR4
Q4, U6

CONTROL BOARD (A4)

(RTP-1009A)

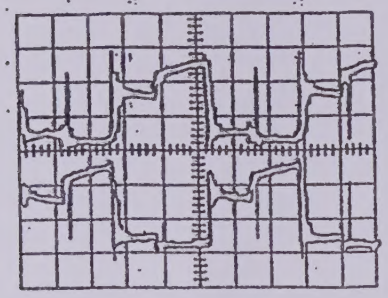
Figure 8-5. Block Diagram



Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 017	1	06-11009C49	RESISTOR	1K-5-1/4
R 018	1	06-11009C01	RESISTOR	10-5-1/4
R 019	1	06-11009C97	RESISTOR	100K-5-1/4
R 020	1	06-11009C73	RESISTOR	10K-5-1/4
R 021	1	06-10621D36	RESISTOR	28.7K-1-1/4
R 022	1	06-10621E28	RESISTOR	255K-5-1/4
R 023	1	06-11009C49	RESISTOR	1K-5-1/4
R 024	1	06-11009C73	RESISTOR	10K-5-1/4
R 025	1	06-11009C77	RESISTOR	15K-5-1/4
R 026	1	06-11009C80	RESISTOR	20K-5-1/4
R 027	1	06-11009C29	RESISTOR	150-5-1/4
R 028	1	06-11009C62	RESISTOR	3.6K-5-1/4
R 029	1	06-10621A97	RESISTOR	100-1-1/4
R 030	1	06-10621D68	RESISTOR	61.9K-1-1/4
R 031	1	06-10621C91	RESISTOR	10K-1-1/4
R 032	1	06-11009C73	RESISTOR	10K-5-1/4
R 033	1	06-10621D27	RESISTOR	23.2K-1-14
R 034	1	06-10621C91	RESISTOR	10K-1-1/4
R 035	1	06-10521D60	RESISTOR	51.1K-1-1/4
R 036	1	06-10621C27	RESISTOR	2.15K-1-1/4
R 037	1	06-11009C49	RESISTOR	1K-5-1/4
R 038	1	06-11009C49	RESISTOR	1K-5-1/4
R 039	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 040	1	06-11009C73	RESISTOR	10K-5-1/4
R 041	1	06-11009C73	RESISTOR	10K-5-1/4
R 042	1	06-11009C73	RESISTOR	10K-5-1/4
R 043	1	06-11009C97	RESISTOR	100K-5-1/4
R 044	1	06-11009C73	RESISTOR	10K-5-1/4
R 045	1	06-11009C73	RESISTOR	10K-5-1/4
R 046	1	06-11009C73	RESISTOR	10K-5-1/4
R 047	1	06-10621C91	RESISTOR	10K-1-1/4
R 048	1	06-11009C13	RESISTOR	33-5-1/4
R 049	1	06-11009C80	RESISTOR	20K-5-1/4
R 050	1	06-11009C80	RESISTOR	20K-5-1/4
R 051	1	06-11009C13	RESISTOR	33-5-1/4
R 052	1	06-11009C73	RESISTOR	10K-5-1/4
R 053	1	06-11009C73	RESISTOR	10K-5-1/4
R 054	1	06-10621D14	RESISTOR	16.9K-1-1/4
R 055	1	06-10621C91	RESISTOR	10K-1-1/4
R 056	1	06-11009C75	RESISTOR	12K-5-1/4
R 057	1	06-10621D70	RESISTOR	64.9K-1-1/4
R 058	1	06-10621C91	RESISTOR	10K-1-1/4
R 059	1	06-10621C91	RESISTOR	10K-1-1/4
R 060	1	06-10621C91	RESISTOR	10K-1-1/4
R 061	1	06-11009C75	RESISTOR	12K-5-1/4
R 062	1	06-11009C83	RESISTOR	27K-5-1/4
R 063	1	06-80036G17	RESISTOR	4.7-5-1/4
R 064	1	06-11009C03	RESISTOR	12-5-1/4
R 065	1	06-11009C89	RESISTOR	47K-5-1/4
R 066	1	06-11045A09	RESISTOR	22-5-1/2
R 067	1	06-11045A09	RESISTOR	22-5-1/2
R 068	1	06-11009C97	RESISTOR	100K-5-1/4
R 069	1	06-11009C73	RESISTOR	10K-5-1/4
R 070	1	06-11009C70	RESISTOR	7.5K-5-1/4
S 001	1	40-80396A06	SWITCH,THERMAL	85 DEG C
TP001	1	09-80331A88	JACK	WHITE
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
TP005	1	09-80331A88	JACK	WHITE
TP006	1	09-80331A88	JACK	WHITE
U 001	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 002	1	51-80340B78	INTEGRATED CIRCUIT	
U 003	1	51-80339B77	INTEGRATED CIRCUIT	
U 004	1	51-80340B78	INTEGRATED CIRCUIT	
U 005	1	51-80343B27	INTEGRATED CIRCUIT	7405N
U 006	1	51-83629M71	INTEGRATED CIRCUIT	
U 007	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 008	1	51-05596E15	INTEGRATED CIRCUIT	
U 009	1	51-80340B01	INTEGRATED CIRCUIT	
U 010	1	51-84561L76	INTEGRATED CIRCUIT	
U 011	1	51-80339B78	INTEGRATED CIRCUIT	
U 012	1	51-80339B78	INTEGRATED CIRCUIT	
VR001	1	48-82256C59	DIODE,ZENER	15V-5-.5
VR002	1	48-82256C59	DIODE,ZENER	15V-10-.5
VR003	1	RG-1N5249B	DIODE,ZENER	19V-5-.5
VR004	1	48-83461E32	DIODE,ZENER	8.2V-5-.5
VR005	1	48-83461E19	DIODE,ZENER	3.9V-10-.5
VR006	1	48-82256C59	DIODE,ZENER	15V-10-.5

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN, FOR COMPLETE DESIGNATIONS PREFIX WITH A5.
2. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT(S).
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN MH.
   ALL VOLTAGES ARE IN DC.



-0V

1V/DIV 5 μSEC/DIV

XFMR AC DR 49,50

CURRENT SENSE AC 34

$\overline{\text{CURRENT SENSE AC}}$ 35

-0V

$\overline{\text{XFMR AC DR}}$ 47,48

XFMR DC DR 15,16,17,18

DC CENTER TAP 19,20,21,22 23,24,25

$\overline{\text{XFMR DC DR}}$ 26,27,28,29

39,40,41,42 NC FOR ISOLATION
43,44,45,46

T1

T2

E1 E2 E3 E4 E5 E6 E7

CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9 CR10 CR11 CR12 CR13 CR14 CR15

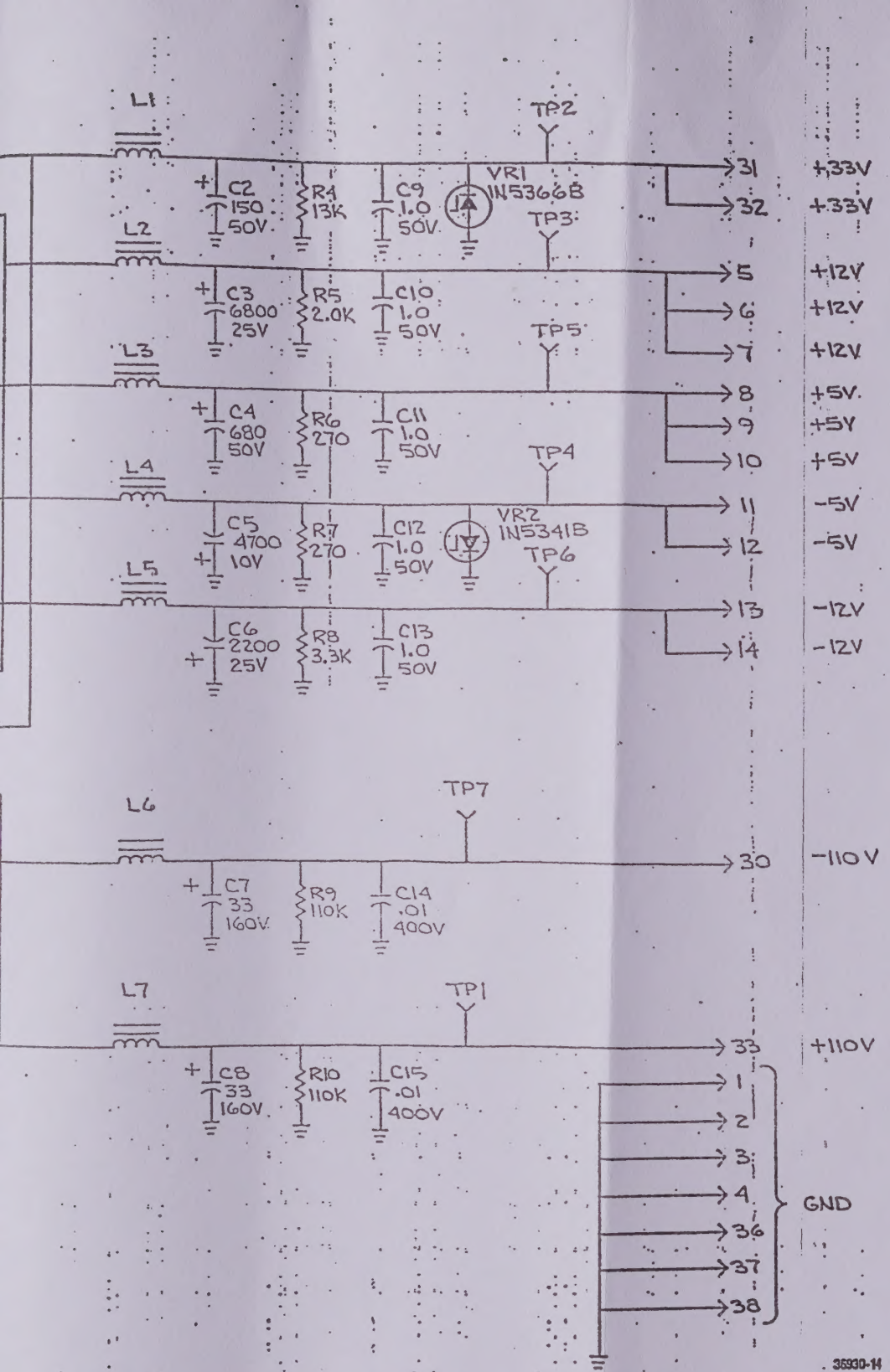
C17 .01 C16 .01

R11 5.6 R12 5.6

15 13 11 20 21 10 19 12 14 18 17 16

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

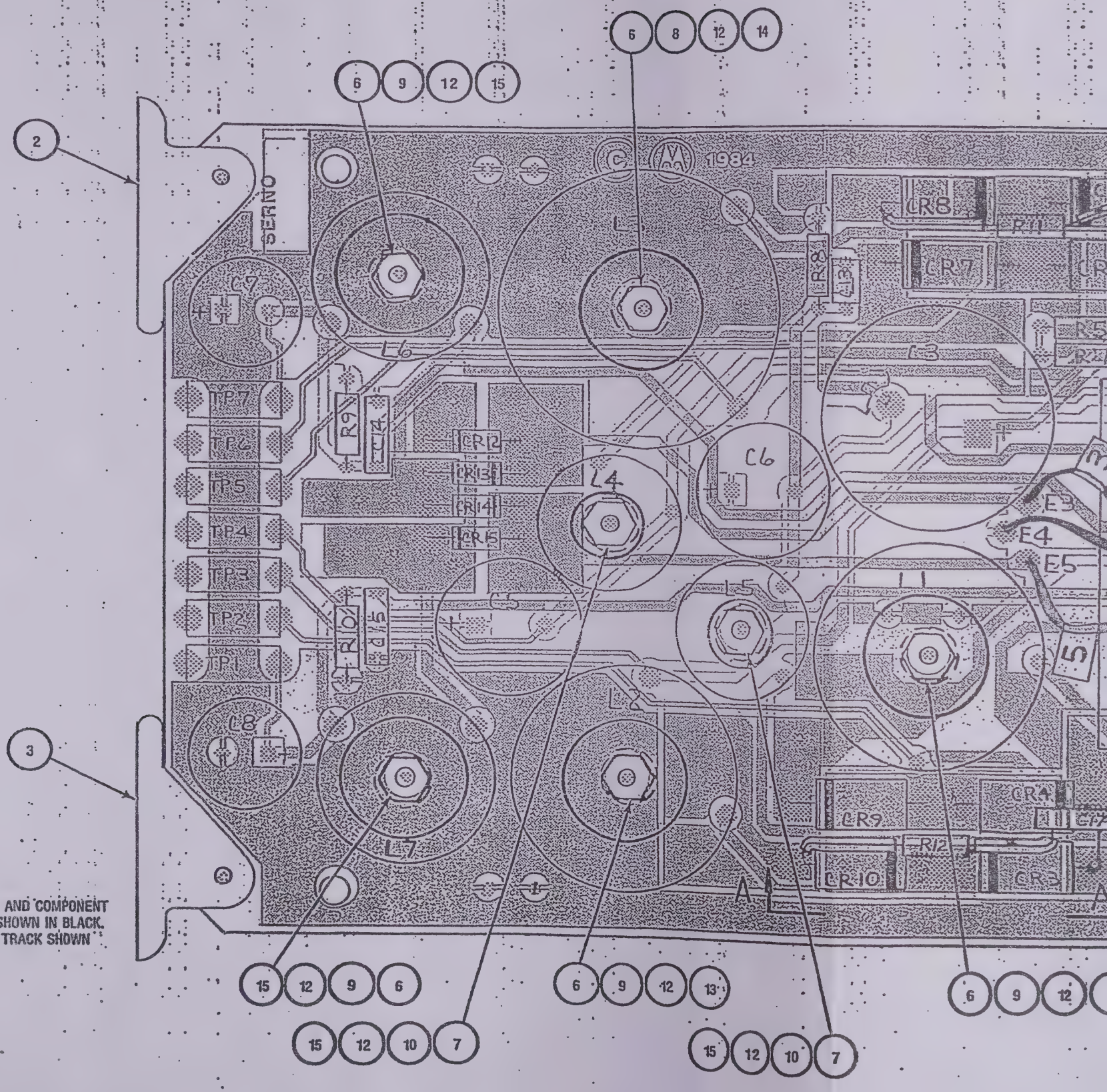
LAST USED	NOT USED
C17	C1
CR15	CR1
E7	
L7	
R12	R1-3
T2	
TP7	
VR2	



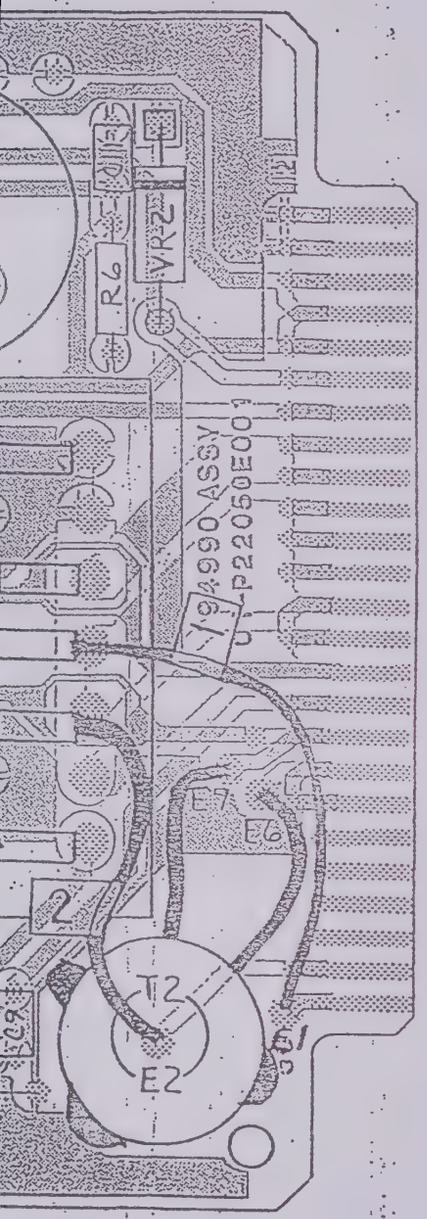
LOW-VOLTAGE POWER SUPPLY OUTPUT BOARD (A5)

(RTP-1010A)

Figure 8-8. Schematic



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.



OUTPUT BOARD (A5)
RTP-1010A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
002	1	45-80339B28	CARD EJECTOR	
003	1	45-80375B38	CARD EJECTOR	
006	5	04-80343B42	WASHER, NYLON SHOULDER	
007	2	04-80343B43	WASHER, NYLON SHOULDER	
008	1	03-80340B66	SCREW, ROUND HEAD NYLON	.112-40X1
009	4	03-80340B69	SCREW, ROUND HEAD NYLON	.112-40X.750
010	2	03-80340B70	SCREW, ROUND HEAD NYLON	.112-40X.625
012	7	02-80375B51	NUT, NYLON LOCK	.112-40X.124
013	2	14-80370A94	INSULATOR	
014	1	14-80370A95	INSULATOR	
015	4	14-80370A96	INSULATOR	
C002	1	23-80341B16	CAPACITOR	150UF-20-50
C003	1	23-80343B65	CAPACITOR	6800UF-20-25
C004	1	23-80343B60	CAPACITOR	680UF+50-10-50
C005	1	23-80341B10	CAPACITOR	4700UF-20-10
C006	1	23-80341B12	CAPACITOR	2200UF-20-25
C007	1	23-80341B05	CAPACITOR	33UF-20-160
C008	1	23-80341B06	CAPACITOR	33UF-20-160
C009	1	21-80342B46	CAPACITOR	1.0UF-20-50
C010	1	21-80342B46	CAPACITOR	1.0UF-20-50
C011	1	21-80342B46	CAPACITOR	1.0UF-20-50
C012	1	21-80342B46	CAPACITOR	1.0UF-20-50
C013	1	21-80342B46	CAPACITOR	1.0UF-20-50
C014	1	08-80343B11	CAPACITOR	.01UF-10-400
C015	1	08-80343B11	CAPACITOR	.01UF-10-400
C016	1	21-80372B73	CAPACITOR	.01UF-10-200
C017	1	21-80372B73	CAPACITOR	.01UF-10-200
CR002	1	48-80340B94	DIODE,400V	FAST RECOVERY
CR003	1	48-80343B23	DIODE,	100V SCHOTTKY
CR004	1	48-80343B23	DIODE,	100V SCHOTTKY
CR005	1	48-80343B23	DIODE,	100V SCHOTTKY
CR006	1	48-80343B23	DIODE,	100V SCHOTTKY
CR007	1	48-80343B23	DIODE,	100V SCHOTTKY
CR008	1	48-80343B23	DIODE,	100V SCHOTTKY
CR009	1	48-80343B23	DIODE,	100V SCHOTTKY
CR010	1	48-80343B23	DIODE,	100V SCHOTTKY
CR011	1	48-80340B95	DIODE	800V FAST RECOVERY
CR012	1	48-80340B95	DIODE,800V	FAST RECOVERY
CR013	1	48-80340B95	DIODE,800V	FAST RECOVERY
CR014	1	48-80340B95	DIODE,800V	FAST RECOVERY
CR015	1	48-80340B95	DIODE,800V	FAST RECOVERY
L001	1	24-80342B56	INDUCTOR	15MH
L002	1	24-80342B57	INDUCTOR	150UH
L003	1	24-80342B58	INDUCTOR	180UH
L004	1	24-80342B59	INDUCTOR	500UH
L005	1	24-80342B60	INDUCTOR	200UH
L006	1	24-80342B61	INDUCTOR	100MH
L007	1	24-80342B61	INDUCTOR	100MH
R004	1	06-11009C76	RESISTOR	13K-5-1/4
R005	1	06-11009C56	RESISTOR	2K-5-1/4
R006	1	06-11009C35	RESISTOR	270-5-1/4
R007	1	06-11009C35	RESISTOR	270-5-1/4
R008	1	06-11009C61	RESISTOR	3.3K-5-1/4
R009	1	06-11009C98	RESISTOR	110K-5-1/4
R010	1	06-11009C98	RESISTOR	110K-5-1/4
R011	1	06-00124B63	RESISTOR	5.6-5-1/4
R012	1	06-00124B63	RESISTOR	5.6-5-1/4
T001	1	25-80342B62	TRANSFORMER	
T002	1	25-80342B63	TRANSFORMER	
TP001	1	09-80331A88	JACK	WHITE
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
TP005	1	09-80331A88	JACK	WHITE
TP006	1	09-80331A88	JACK	WHITE
TP007	1	09-80331A88	JACK	WHITE
VR001	1	48-80342B18	DIODE,ZENER	39V-5-S
VR002	1	48-80342B17	DIODE,ZENER	6.2-5-S

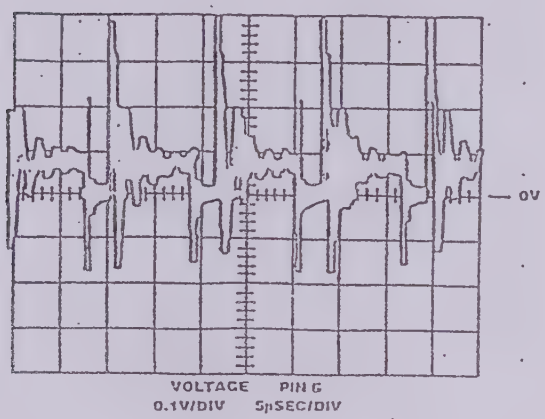
LOW-VOLTAGE POWER SUPPLY
OUTPUT BOARD (A5)
(RTP-1010A)

Figure 8-9a. Printed Wiring Board Assen and Parts List

8-15/16

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH A6.
2. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT(S).
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN MH.
   ALL VOLTAGES ARE IN DC.
3. FOR 28V OPTION REMOVE CONDUCTIVE TRACK BETWEEN EMITTER AND COLLECTOR OF Q OPT AND ADD OPTIONAL COMPONENTS.



LAST USED	NOT USED
C15	C6,C9,C13
CR4	
K1	
L3	
Q4	
R24	R2,R3,R7
U1	R8,R9,R10
T1	R16,R17
VR7	

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

AC DRIVE
$\overline{\text{AC DRIVE}}$
GND
DC IN
$\overline{\text{RELAY ON}}$
DC DRIVE
$\overline{\text{DC DRIVE}}$

TP3
T1
PEG3387
R23
22Ω
R11
43
CR3
IN5817
TP4
CR4
IN5817
R12
43
LI
11-19V
C14
0.1
VR1
IN6288A
51V
C1
470
50V
C2
2200
50V
C15
0.1
TP1
R4
10
VR6
IN965
TP2
R5
10
VR7
IN965

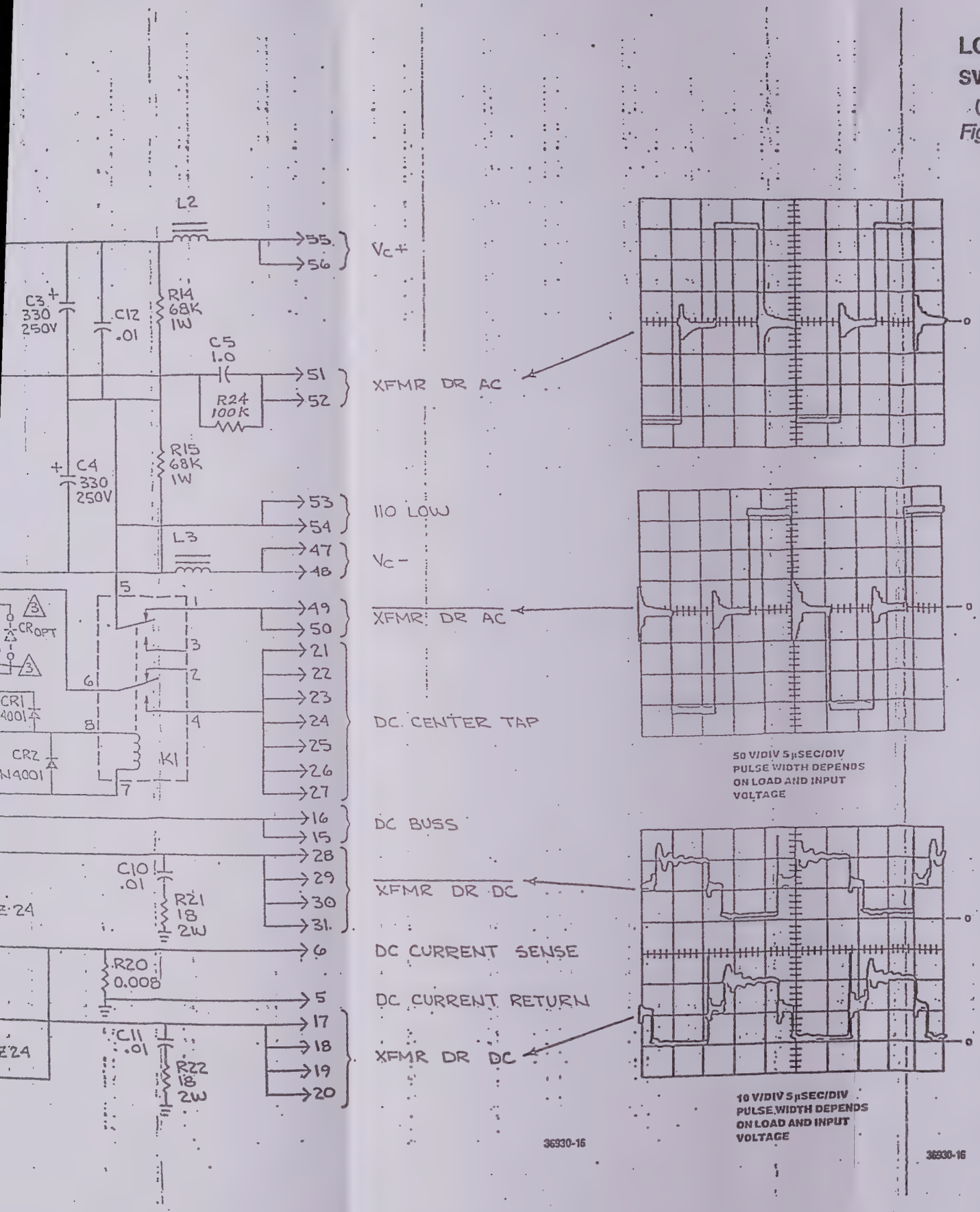
39,40,41,42,43,44
45,46,57,58,59,60 NC FOR ISOLATION

LOW-VOLTAGE POWER SUPPLY

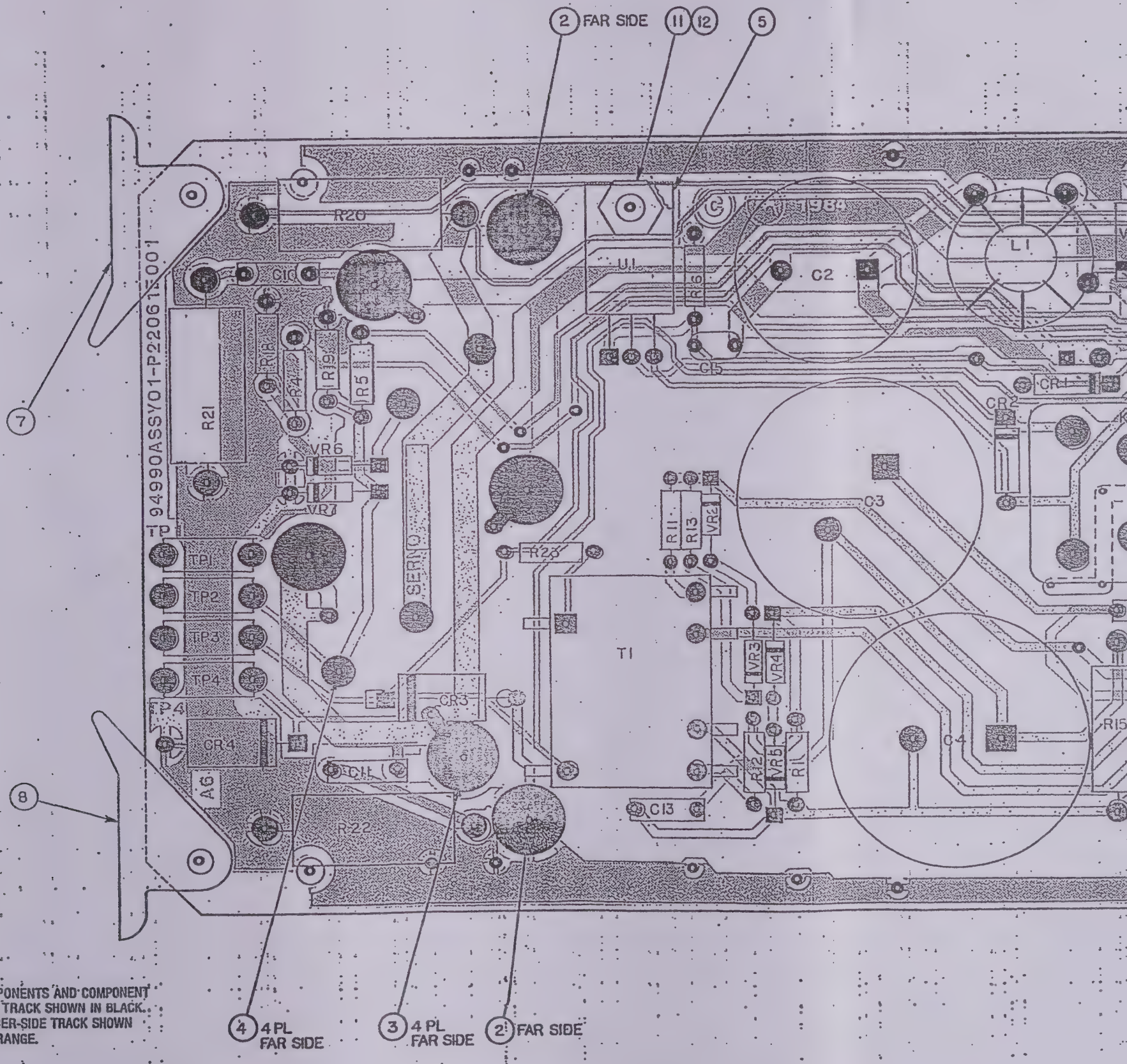
SWITCHER BOARD (A6)

(RTP-1011A)

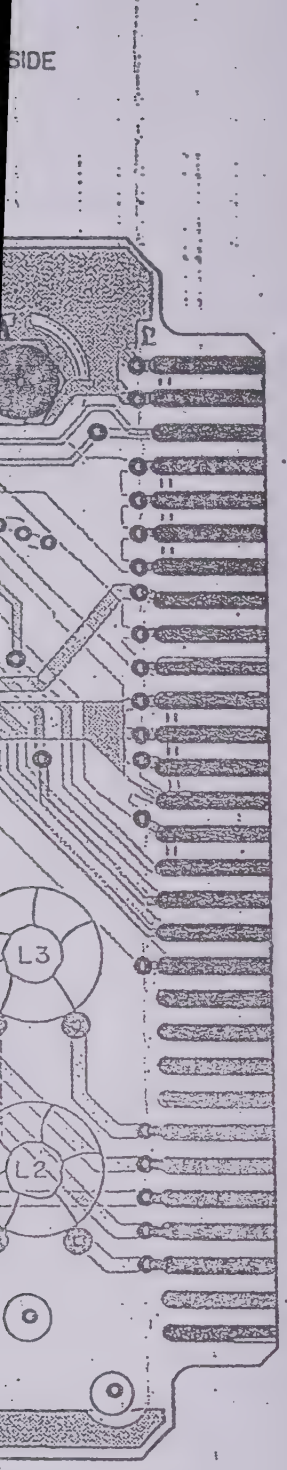
Figure 8-10. Schematic



8-17/18 blank



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.



SWITCHER BOARD (A6)
RTP-1011A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
002	3	43-80375B31	SPACER, SWAGE	
003	4	43-80375B32	SPACER, SWAGE	
004	4	09-80341B42	RECEPTACLE,COMPONENT	
005	1	14-80344B21	INSULATOR,T0220	BERQUIST.
007	1	45-80339B28	CARD EJECTOR	
008	1	45-80339B39	CARD EJECTOR	MARKED
011	1	02-80340B05	NUT,NYLON LOCK	.1120-40
012	1	03-80340B68	SCREW,ROUND HEAD NYLON	.1120-40X0.25
C001	1	23-80341B19	CAPACITOR	470UF-20-50
C002	1	23-80341B08	CAPACITOR	2200UF-50
C003	1	23-80343B63	CAPACITOR	330UF-20-250
C004	1	23-80343B63	CAPACITOR	330UF-20-250
C005	1	23-80340B93	CAPACITOR	1.0UF-20-250
C010	1	08-80343B11	CAPACITOR	0.01UF-10-400
C011	1	08-80343B11	CAPACITOR	0.01UF-10-400
C012	1	08-80343B11	CAPACITOR	0.01UF-10-400
C013	1	08-80343B11	CAPACITOR	0.01UF-10-400
C014	1	21-80342B10	CAPACITOR	.1UF-20-50
C015	1	21-80342B10	CAPACITOR	.1UF-20-50
CR001	1	48-82466H13	DIODE	
CR002	1	48-82466H13	DIODE	
CR003	1	48-80342B20	DIODE	
CR004	1	48-80342B20	DIODE	
K001	1	80-80340B09	RELAY	10A-DPDT
L001	1	24-80342B64	INDUCTOR	5UH
L002	1	24-80342B65	INDUCTOR	23UH
L003	1	24-80342B65	INDUCTOR	23UH
R001	1	06-11009C57	RESISTOR	2.2K-5-1/4
R004	1	06-11009C01	RESISTOR	10-5-1/4
R005	1	06-11009C01	RESISTOR	10-5-1/4
R006	1	06-11009C97	RESISTOR	100K-5-1/4
R011	1	06-00124A16	RESISTOR	43-5-1/4
R012	1	06-00124A16	RESISTOR	43-5-1/4
R013	1	06-11009C57	RESISTOR	2.2K-5-1/4
R014	1	06-00126A93	RESISTOR	68K-5-1
R015	1	06-00126A93	RESISTOR	68K-5-1
R018	1	06-11009C65	RESISTOR	4.7K-5-1/4
R019	1	06-11009C65	RESISTOR	4.7K-5-1/4
R020	1	06-00340B08	RESISTOR	0.008-1-2
R021	1	06-00127A07	RESISTOR	18-5-2
R022	1	06-00127A07	RESISTOR	18-5-2
R023	1	06-11009C09	RESISTOR	22-5-1/4
R024	1	06-00124A97	RESISTOR	100K-5-1/4
T001	1	25-80343B78	TRANSFORMER	
TP001	1	09-80331A88	JACK	WHITE
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
U001	1	51-84621K22	INTEGRATED CIRCUIT	
VR001	1	48-80342B21	DIODE,ZENER	
VR002	1	48-82256C59	DIODE,ZENER	15V-20-.5
VR003	1	48-82256C59	DIODE,ZENER	15V-20-.5
VR004	1	48-82256C59	DIODE,ZENER	15V-20-.5
VR005	1	48-82256C59	DIODE,ZENER	15V-20-.5
VR006	1	48-82256C59	DIODE,ZENER	15V-20-.5
VR007	1	48-82256C59	DIODE,ZENER	15V-20-.5

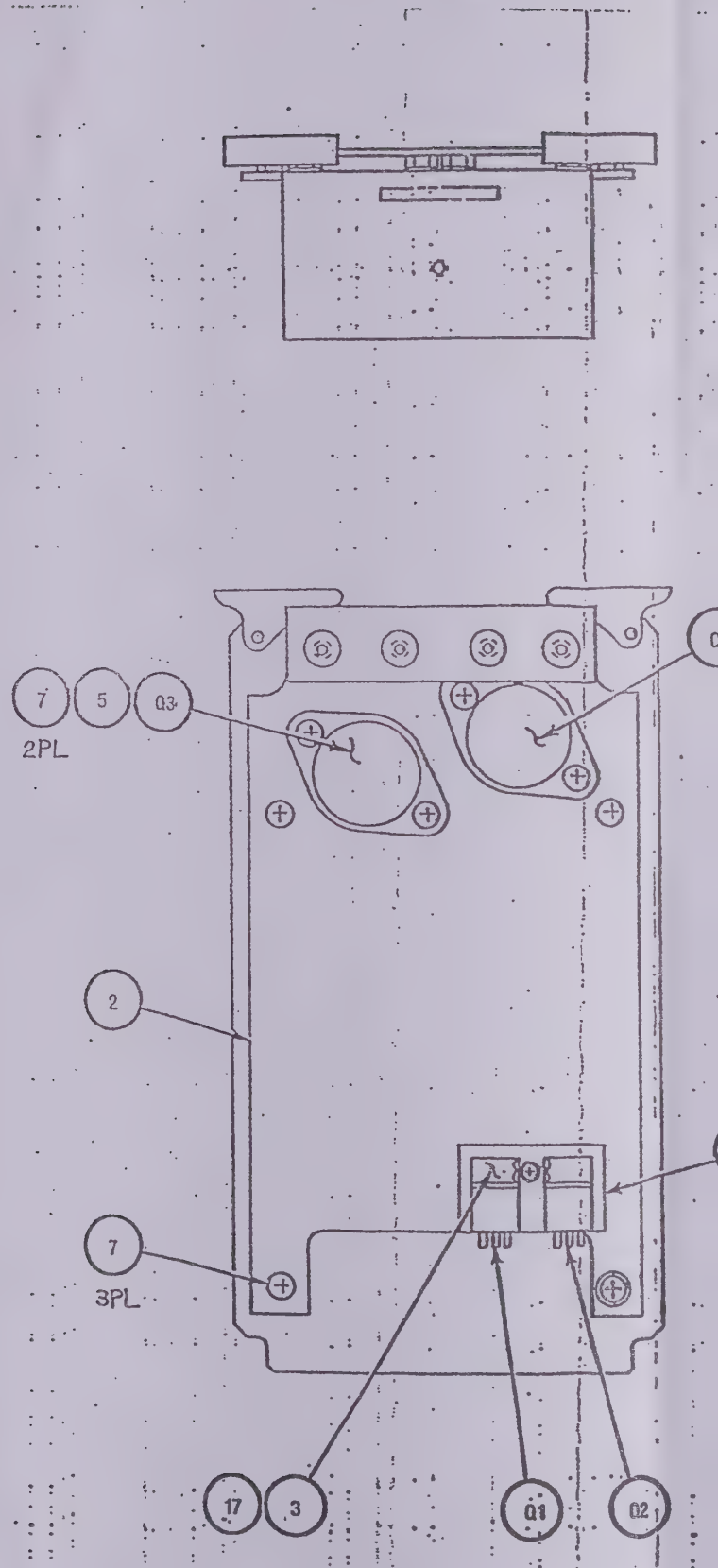
Figure 8-11. Printed Wiring Board Assembly and Parts List

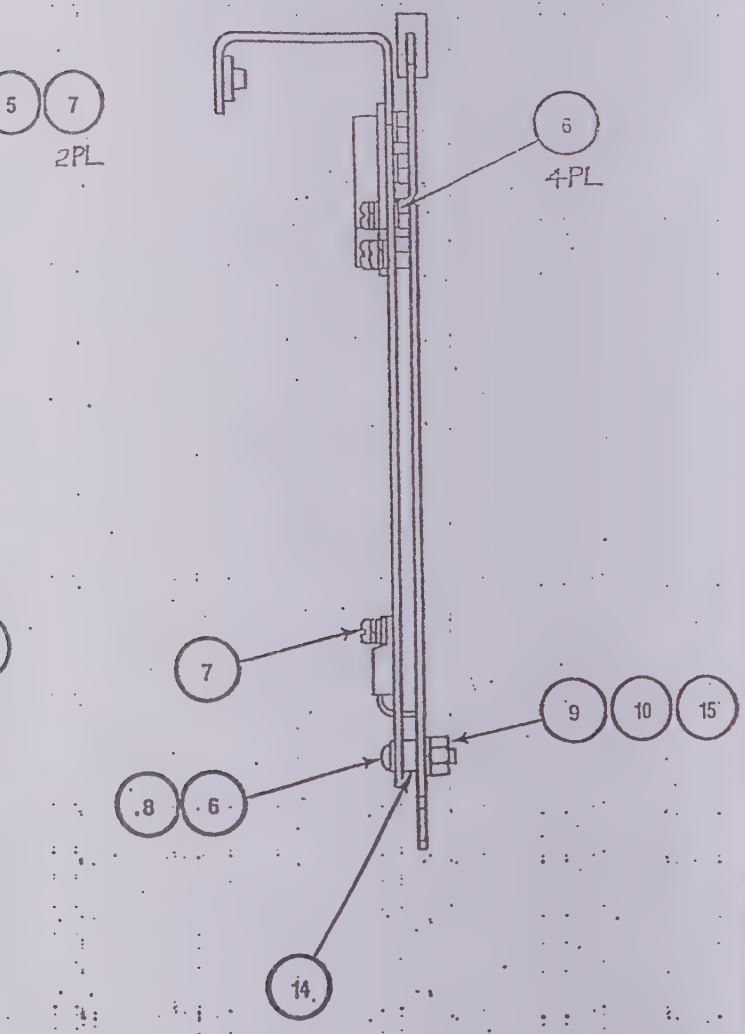
LOW-VOLTAGE POWER SUPPLY

SWITCHER BOARD (A6)

(RTP-1011A)

Figure 8-12. Assembly and Parts List





SWITCHER BOARD (A6)
RTP-1011A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
002	1	26-80375B10	HEATSINK	
003	1	42-80375B15	RETAINER	
004	1	14-80370A93	INSULATOR	
005	2	14-80370A92	INSULATOR, BREQUIST	
006	5	03-80375B11	WASHER, NYLON SHOULDER	
007	8	03-138148	SCREW, PH W/CAPT LOCK WASHER	4-40X.375
008	1	03-139818	SCREW	.112-40X.438
009	1	04-140358	WASHER	.112
010	1	04-9777	WASHER, LOCK	.112
014	1	43-80343B71	SPACER	1/4" ROUND
015	1	02-120486	NUT	.112-40
017	1	42-80375B16	RETAINER	
Q 001	1	48-80339B04	TRANSISTOR,MOSFET	
Q 002	1	48-80339B04	TRANSISTOR,MOSFET	
Q 003	1	48-80339B03	TRANSISTOR,MOSFET	
Q 004	1	48-80339B03	TRANSISTOR,MOSFET	

SECTION 9.
SCOPE/DVM CONTROL BOARD (A7)

9.1 DESCRIPTION

The primary function of the Scope/DVM Control board is to route the required measurement and viewing signals to the digital voltmeter (DVM) and scope circuitry. A large portion of the displayed data is determined by DVM measurements on internal signal points. Thus, for a rapid update of several data displays, several internal signal points must be time-division multiplexed to the DVM. The DVM Control circuitry and the system processor provide this function.

With the Scope Control circuitry, the user can choose to display either data information, or signals for internal modulation or demodulation, or external scope inputs. The horizontal sweep provided for the spectrum-analyzer display is coherent with the synthesizer sweep generator. The coherent horizontal sweep and synthesizer sweep can be used for an external filter-alignment display. An external horizontal input is also possible.

The Scope/DVM Control board also contains the 1-kHz notch filter and the rectifier circuit used for distortion measurements.

A block diagram of the Scope/DVM Control board is shown at the end of this section in Figure 9-1, a schematic in Figure 9-2, and the printed wiring board assembly and parts list in Figure 9-3.

9.2 THEORY OF OPERATION

9.2.1 SCOPE VERTICAL CONTROL

The input to the scope vertical amplifier is switched by the scope vertical-select switch (U6) to one of four sources: the range switch (VERT FROM RNG SW), the vertical character-sweep generator, the spectrum analyzer (SPECT ANA VERT), or the 700-kHz IF. Inputs to the range switch, which are routed through the range switch on the Front-Panel Interface board (A15), come from either 1) the scope's vertical-input port on the front panel or 2) the internal modulation signals, as selected by this board's control circuitry for modulation display. The vertical character sweep is a sawtooth waveform generated by the vertical character-sweep generator and synced by the VERT CHAR SYNC signal from the character generator on the Processor board (A14). The detected and amplified output of the Receiver logarithmic IF is the vertical input for the spectrum analyzer. The remaining signal source is the second IF signal from the Receiver for IF envelope observation.

9.2.2 DUAL-DISPLAY CONTROL

The dual-display control circuitry produces a screen with a single row of characters at the top of the CRT and a display for either the spectrum analyzer or the scope. This function is implemented with the vertical sweep control by alternating the signal for the spectrum analyzer or the range switch with the signal for the vertical character sweep.

The dual-display sequence starts with the synthesizer sweep generator (U12, U51A, U59A), which is common to the displays for both the spectrum analyzer and the scope. This sweep generator is started with a pulse of the SYNTH 100 Hz input signal, which fires the one-shot U12B. This also enables the scope Z-axis. Now the display for either the spectrum analyzer or the scope is being traced on the CRT.

When the synthesizer sweep reaches 2.5 Vdc (that is, the scope's horizontal sweep is at the edge of the screen), the dual-display control circuitry (U10B, U11, U12A, Q6) activates the $\overline{\text{CHAR GEN RST}}$ line. This switches the scope's vertical and horizontal inputs to the character-sweep generators. The vertical sweep generator (U3, U4) determines the CRT frame rate of 61 Hz. The horizontal character-sweep generator (U60) determines the row rate of 7812.5 Hz; eight rows make a character height. The vertical and horizontal character generators are synchronized by the character generator on the Processor board (A14).

When the first line of characters has been traced, a transition on the $\overline{\text{LINE 1}}$ input from the A14 board resets both character-sweep generators, and increments the character counter (U13). This causes LINE 1 to be traced again. This process is repeated four times, at which point the counter output resets the scope inputs to "spectrum analyzer" or "range switch." During the retrace time, the scope Z-axis is blanked by U30D and is held off until the synthesizer sweep starts. The timing of the process allows the four character traces to be completed before the next synthesizer sweep-sync.

9.2.3 SCOPE HORIZONTAL CONTROL

Switching for the scope horizontal input is divided between two boards. The timebase generator and the external horizontal input are selected on the Scope Amplifier board (A2). The horizontal character-sweep generator and the signals for the synthesizer sweep generator are selected on the A7 board by the scope horizontal switches (U52A and U52D) and sent to the INT SCOPE HORIZ signal line.

Table 9-1. Internal DVM Inputs

DVM Inputs	Function
+ Peak Voltage	Positive modulation measurements
− Peak voltage	Negative modulation measurements
Carrier Level	RF output level
RF INPUT PWR	Power level applied to the RF Input/Output port
EXT FWD PWR	Forward power level on external inline-wattmeter element
EXT RFL PWR	Reflected power level on external inline-wattmeter element
BATT VOLT	Voltage level at dc input port on the rear panel divided by 10
SIG STRENGTH VOLTAGE	DC level proportional to the level in dBm of the received signal
Distortion Meter Input	DC level proportional to the signal power at the input of the SINAD/DISTORTION notch filter

9.2.9 EXTERNAL DVM/DISTORTION CONTROL

External DVM and distortion inputs to the front panel port are ranged by processor control over four decades on the Front-Panel Interface board (A15). The resulting output is routed to the DVM FROM RNG SWITCH input of the A7 board. This signal is input to the DVM/Distortion Select circuitry (U30B and U30C) and the gain stage of 6.5 (U62) preceding the 1-kHz notch filter.

9.2.10 DISTORTION MEASUREMENT

In the distortion mode, the DVM/Distortion Select circuitry routes the output of the 1-kHz notch filter (U62 and U63) to the EXTERNAL DVM TO A/D output pin. This output pin is connected to the rms-to-dc converter on the A11 board. The output of the rms-to-dc converter is multiplexed to the A/D converter and read by the processor. The input to the notch filter is rectified and filtered by U3, and applied to the Internal DVM Select for reading by the processor (as discussed in paragraph 9.2.8). To obtain the percent distortion for a 1-kHz input, the processor divides the rms output voltage of the notch filter by the average rectified input voltage to the notch filter. The notch filter has a processor-controlled gain that is switched to either ×10 or × 1.0, depending on input distortion and signal levels.

9.2.11 EXTERNAL DVM MEASUREMENT

In the external DVM mode, the DVM FROM RNG SWITCH input is routed by the DVM/Distortion Select circuitry directly to the EXT DVM TO A/D output. At this point, it is connected to the rms-to-dc converter on the A11 board. The output of the rms-to-dc converter is multiplexed to the A/D converter, where it is read by the processor.

9.2.12 AUDIO AMPLIFIER AND ALARM GENERATOR

An astable multi-vibrator (U61 and U50) operating at 1.2 kHz is the alarm generator. The alarm signal, controlled by the processor, is summed with the VOL CNTL AUD RTN signal at the input of the audio amplifier (U7). The SPEAKER AUDIO output of the amplifier has a 0.5W capability and is connected directly to the system speaker.

9.2.13 BOARD CONTROL

Processor control of the Scope/DVM Control board is via three signal lines: the AF ADD BUS 0-3, the AF DATA BUS 0-3, and the AF BUS EN 1. The four address bits are decoded by the address decoder (U46) to determine which control latch the four bits of data will be latched into. The latching process is synchronized by the AF BUS EN 1 line. Control latches in addition to those necessary for controlling this board (A7) provide control for the Scope Amplifier board (SCOPE SWP 0-2) and part of the RF Input module (ANTENNA ENABLE).

SECTION 10.
RECEIVER BOARD (A8)

10.1 DESCRIPTION

The Receiver board recovers baseband signals and determines input-carrier levels. The 10.7-MHz IF input signal can be amplitude (AM), frequency (FM), or single sideband (SSB) modulated with the baseband information.

Separate detectors are provided for AM, FM, and SSB; the demodulated outputs are routed to the audio filters.

Selectable high-pass and low-pass filters then further process the baseband signal before it leaves the Receiver board. Separate board outputs provide baseband signals to the front panel, to the circuitry for determining modulation level, and to the speaker amplifier.

Input-carrier level is determined by a logarithmically responding amplifier. The amplitude of the output signal from the log amplifier is proportional to the log of the input-carrier level. This output, which is used for the spectrum-analyzer mode, also provides a signal-strength level for the squelch circuitry.

The system processor provides primary control of the Receiver board's functions via a serial data bus. The data bus uses a single data line, a clock line, and a latch-enable line to serially shift control information from the Processor board to the Receiver board.

Block diagrams of the Receiver board and its functions are shown at the end of the section in Figure 10-1a-e, a schematic in Figure 10-2, and the printed wiring board assembly and parts list in Figure 10-3.

10.2 THEORY OF OPERATION

10.2.1 LINEAR IF SECTION

10.2.1.1 General

The linear IF section consists of 1) a tuned, gain-controlled filter amplifier with switchable bandwidths, 2) an AGC amplifier, 3) an overload detector driven by the AM-detected output, and 4) an AM detector. RF outputs are provided to the scope, the FM limiter, the SSB-product detector and the logarithmic amplifier. The AM demodulated audio signal is provided to the audio-filter circuits.

A block diagram of the linear IF amplifier is shown in Figure 10-1b at the end of the section.

10.2.1.2 Pre-Selector

The linear IF is preceeded by a pre-selector. This limits the number of out-of-band signals reaching the pre-amplifier and provides a good termination for the first mixer/low-pass filter located on A17A2. The pre-selector is fixed-tuned without adjustment and has a bandwidth of 2 MHz (Q = 5).

10.2.1.3 Pre-Amplifier/Filter

The pre-selector is followed by a low-noise pre-amplifier(a grounded gate with a source follower) with a gain of 28 dB. This pre-amplifier provides good impedance-matching for input/output of the mixer and FL301 (a 6-pole ceramic filter with a bandwidth of 280 kHz), as well as the ability to handle high-level signals. The high gain of this pre-amplifier negates both the 9-dB loss associated with FL301 and the 3-dB power-split following the filter. FL301 determines the wideband frequency response and rejection of the Receiver and logarithmic amplifier (log amp).

10.2.1.4 Active Power Split

A matched pair of parallel, grounded-gate J Fet amplifiers equally split the received signal between the linear IF and log IF. The grounded-gate amplifier provides isolation between the two IF strips as well as a good impedance match for the output of FL301. No automatic gain control (AGC) is applied before this point to maintain calibration of the log amp. This requires a high dynamic-range amplifier inherent in the grounded-gate approach.

10.2.1.5 Switched IF Filters and 10.7-MHz Amplifier

The IF bandwidth is determined by a wideband/narrowband filter-set, selectable under software control. Switching occurs downstream of the log-amp pick-off, in order to maintain log-amp calibration. FL303, (a 2-pole, wideband ceramic filter) reduces image noise to the mixer in wideband mode. FL302 sets the narrowband pre-detection bandwidth and adjacent-channel rejection of the Receiver. Q305 serves as an AGC'd amplifier to terminate the filters and isolate them from the active mixer (U302). Diodes driven by U301 (an RS232 driver) do the filter-switching. This provides level translation and drive capability from the control circuit.

10.2.2.7 Log-Amp Gain and Offset Adjust

To convert the log-amp detector's output to the equired level for the Scope Amplifier's input, an operational amplifier (U206A) is configured as an inverting amplifier to perform the overall gain and offset scaling. To compensate the TC of the logging IC, the offset voltage is temperature-tracked via CR204. The output voltage is 50 mV/dB with −80 dBm, providing 0.0 Vdc out. The absolute output depends on the losses in the A17.

10.2.2.8 Base-Line Limiter

The spectrum-analyzer display is base-line limited to prevent the display from dropping below the bottom of the screen. A precision rectifier circuit (U206 and CR203) clamps the log-amp output whenever it goes below −2.000 volts.

10.2.2.9 Offset Buffer Amplifier

The log-amp's calibrated output from U206A is amplified and offset to conform with the System Analyzer's internal DVM. This DVM requires a unipolar input with a 0 to 10V range.

10.2.3 FM/SSB/WB SIGNAL-PRESENT DETECTORS

10.2.3.1 General

In addition to AM detection, which is described in the linear IF section 10.2.1.8, the Receiver incorporates a pulse-counting FM discriminator, a product detector/BFO for SSB/CW demodulation, and a wideband signal-present detector. The latter tests for the presence of a sufficiently strong signal for the Scan Lock function and flags the CPU when a signal of sufficient amplitude is present.

A block diagram of the FM/SSB/WB signal-present detector is shown at the end of the section in Figure 10-1d.

10.2.3.2 IF Limiter

The IF output is hard-limited by Q310/Q311 configured as an emitter-coupled amplifier with positive feedback. A high-speed, CMOS hex-inverter (U310) buffers the limiter's output to the pulse-counting discriminator and to the IF/BFO frequency-counter select gate. The limiter will provide an accurate frequency to the counter in the presence of as much as 90 percent AM.

10.2.3.3 Pulse-Counting Discriminator

The pulse-counting (averaging) technique is used for FM demodulation. That is, a constant width and amplitude pulse is generated for each zero-crossing of the IF signal. The pulses are then averaged in an RC low-pass filter to generate a voltage proportional to the input frequency. The output is then a dc voltage proportional to the average frequency, with the FM-demodulated signal riding on top. The Receiver uses a dual-edge, triggered monostable (U311/U312) to provide a pulse with each zero-crossing, thereby doubling the carrier frequency and easing the filtering requirements. Differential amplification by U313 removes the dc offset and increases detection-gain by 6 dB. The pulse width is set for a 50 percent duty cycle at 700 kHz, the nominal IF-center frequency. U314A provides additional filtering and FM-gain calibration.

10.2.3.4 Product Detector

Reinjection of the carrier in a product detector demodulates SSB and CW. An active mixer (U317) performs the detection; it requires a low-level BFO-injection signal minimizing shielding requirements. Q313 and Q314 form a feedback filter amplifier to 1) amplify the detected SSB/CW output, 2) filter the IF/BFO components, and 3) provide a low output impedance to the audio filters.

10.2.3.5 BFO

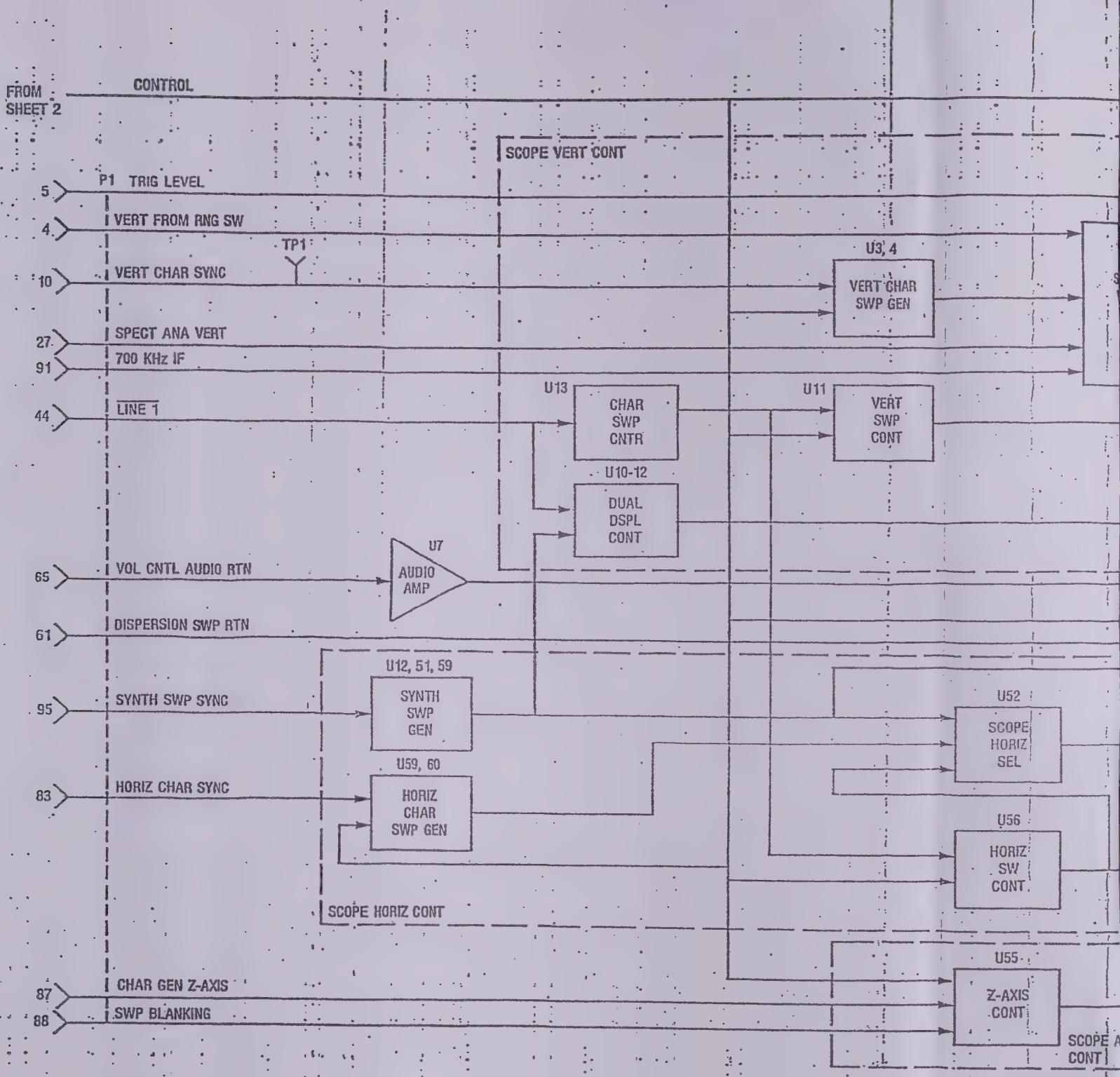
The BFO (Q306) is a modified Colpitts-type oscillator with gate-bias AGC. The oscillator nominal frequency of 700 kHz is adjustable ±3 to 5 kHz from the front panel. Select-in-test C377 provides centering of C394's adjustment range. As a buffer, Q307 isolates the BFO from the product detector and the frequency counter. Under software control, Q315 disables the BFO when the Receiver is not in SSB mode.

10.2.3.6 Wideband Signal-Present Detector

The wideband signal-present detection circuit is used only for the Scan Lock function. U307 provides an amplified (40 dB) signal to the frequency counter via counter-output select gate U315, which, in conjunction with the 20-MHz low-pass filter following the first mixer on A17A2, allows the System Analyzer to determine the frequency of a signal within 20 MHz of the L.O. frequency. U308 monitors the signal strength of the incoming signals. When the input signal is of sufficient level and the L.O. is within 20 MHz, U308 flags the microprocessor, which then determines the frequency. U308 is set to trip at a nominal level of −50 dBm into A8J1, the Receiver input.

10.2.3.7 Counter-Output Select Gate

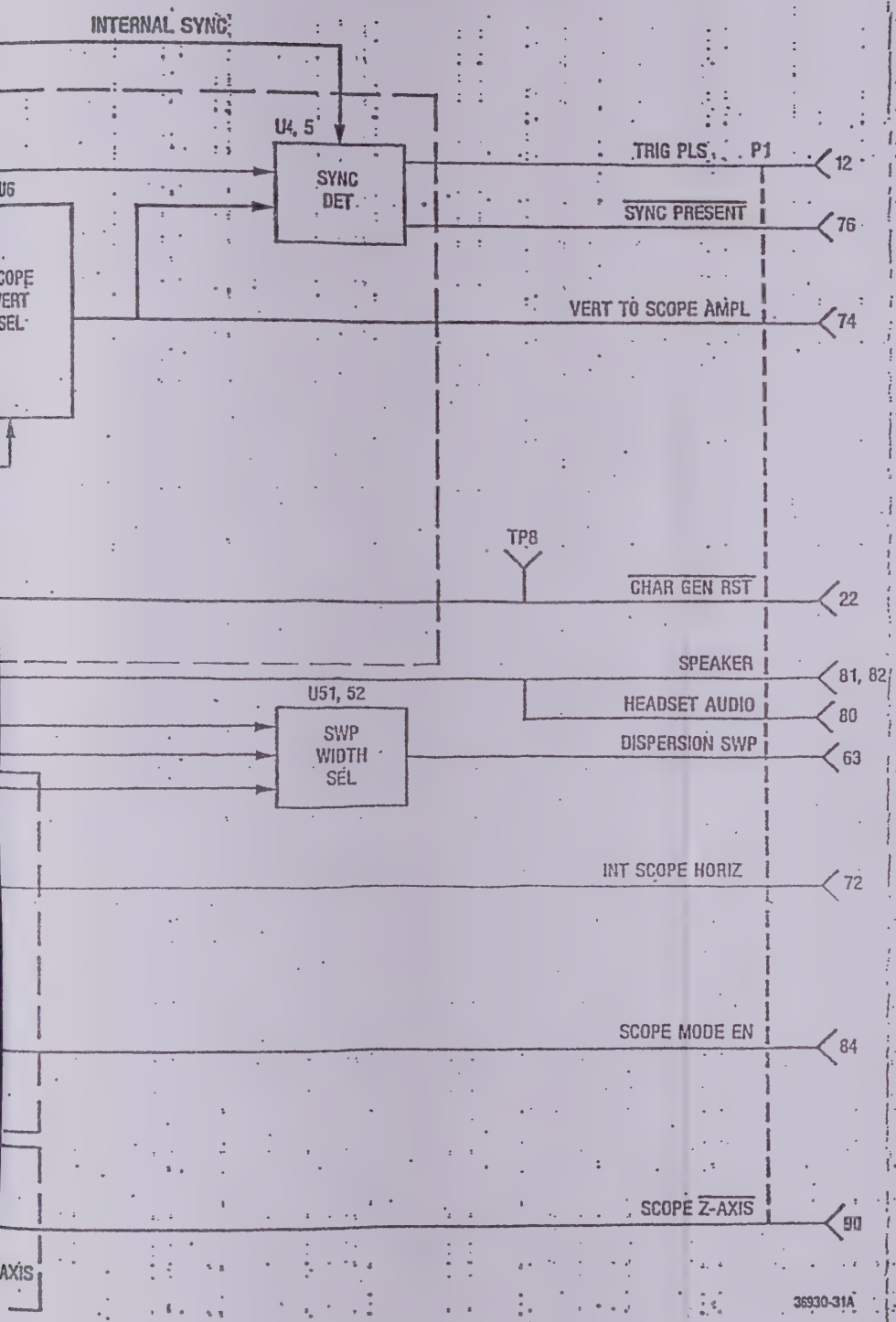
The BFO, the limited-IF output, or the wideband signal-present output are selected and routed to the internal frequency counter under software control via U315. The Processor board then determines the error frequency relative to the programmed L.O. frequency that is displayed on the CRT in receive mode.


FROM SHEET 2
CONTROL
SCOPE VERT CONT
P1 TRIG LEVEL
5
VERT FROM RNG SW
4
TP1
VERT CHAR SYNC
10
U3, 4
VERT CHAR SWP GEN
SPECT ANA VERT
27
700 KHz IF
91
U13
CHAR SWP CNTR
U11
VERT SWP CONT
LINE 1
44
U10-12
DUAL DSPL CONT
U7
AUDIO AMP
VOL CNTL AUDIO RTN
65
DISPERSION SWP RTN
61
U12, 51, 59
SYNTH SWP GEN
SYNTH SWP SYNC
95
U52
SCOPE HORIZ SEL
U59, 60
HORIZ CHAR SWP GEN
HORIZ CHAR SYNC
83
U56
HORIZ SW CONT
SCOPE HORIZ CONT
U55
Z-AXIS CONT
CHAR GEN Z-AXIS
87
SWP BLANKING
88
SCOPE A
CONT

SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

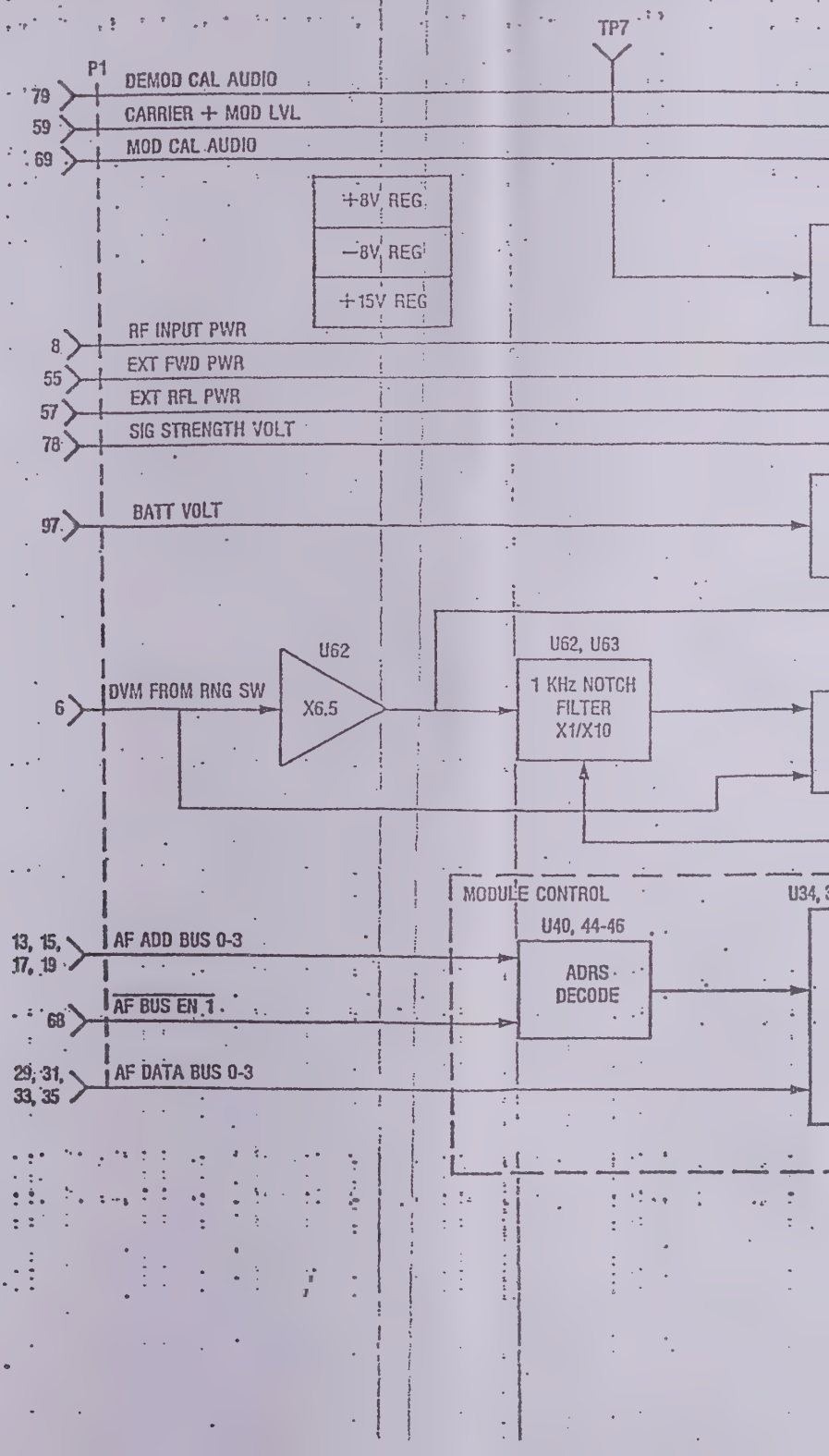
Figure 9-1a. Block Diagram (Sheet 1 of 2)

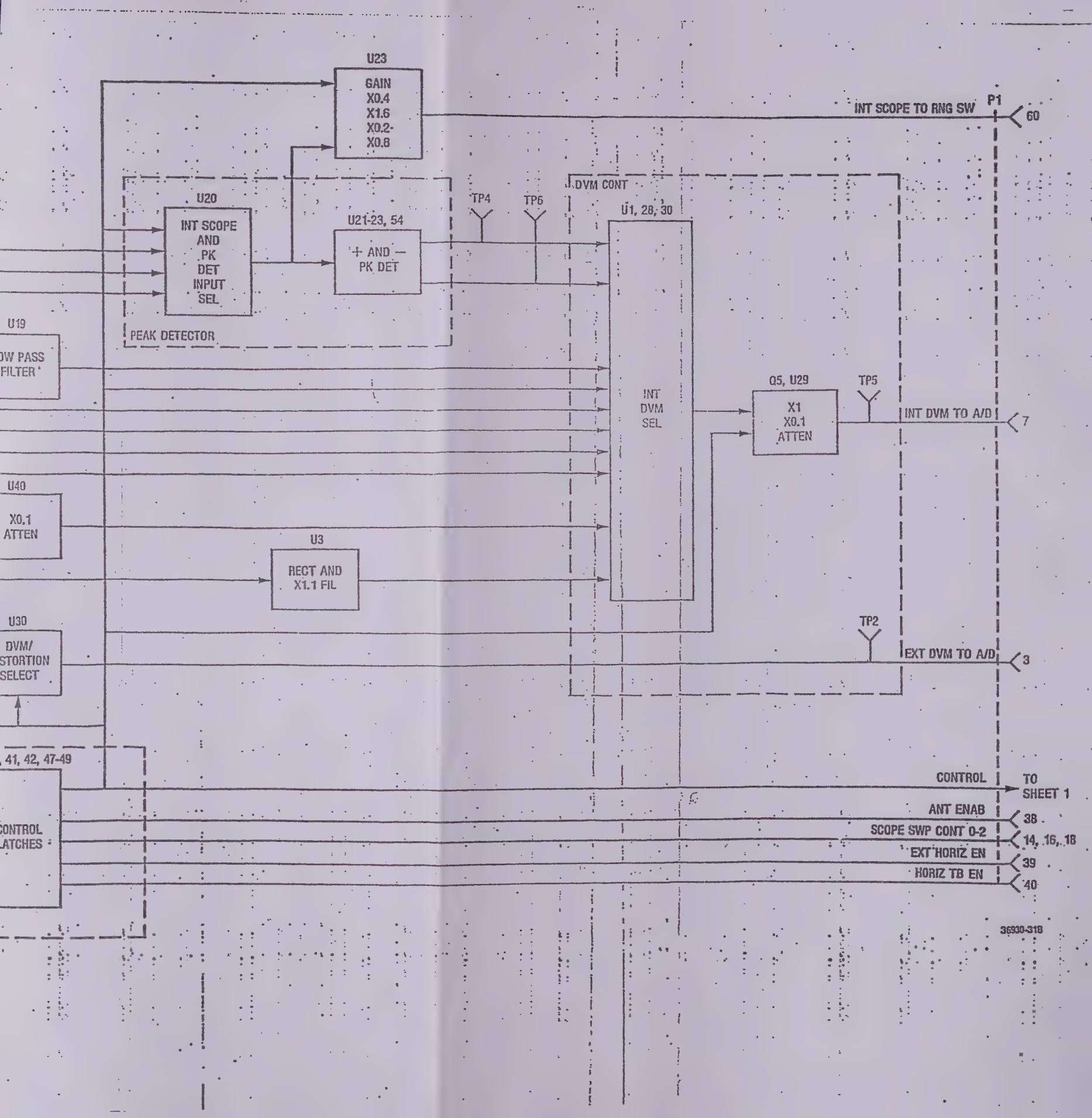


SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-1b. Block Diagram (Sheet 2 of 2)




U23
GAIN
X0.4
X1.6
X0.2-
X0.8
INT SCOPE TO RNG SW
P1
60
U20
INT SCOPE AND PK DET INPUT SEL
U21-23, 54
+ AND — PK DET
TP4
TP6
DVM CONT
U1, 28, 30
PEAK DETECTOR
U19
OW PASS FILTER
INT DVM SEL
Q5, U29
X1
X0.1
ATTEN
TP5
INT DVM TO A/D
7
U40
X0.1
ATTEN
U3
RECT AND X1.1 FIL
U30
DVM/
STORTION
SELECT
TP2
EXT DVM TO A/D
3
41, 42, 47-49
CONTROL
ATCHES
CONTROL
TO SHEET 1
ANT ENAB
38
SCOPE SWP CONT 0-2
14, 16, 18
EXT HORIZ EN
39
HORIZ TB EN
40
36930-318

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH 1A1.
2. FOR REFERENCE DRAWINGS REFER TO ASSY NO. 01-972016.
3. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5% PCT, 1/4 WATTS.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.

REF DES	DEVICE	GND	+V MIN	-V MIN	NO CONNECT
U1	HI-201-5	5,14	12	4	12
U2					
U3	MLM324		4	11	
U4	LM393		8	4	
U5	MC14528		16	8	9
U6	HI-201-5	5	12	4	12
U7	LM386	6		4	1,7,8
U8					
U9					
U10	LM393		8	4	
U11	MC14011		14	7	
U12	MC14528		16	8 (8/7)	7,10
U13	MC14017		16	8	1-7,9,11,12
U17	MC14066	7,8	14	7	8,9
U19	CA3160	4	7		1,5,8
U20	HI-201-5	5	13	4	12
U21	CA3140		7	4	8
U22	CA3240		8	4	
U23	CA3240	3	15	4	
U24	MC14001		14	7	
U25					
U26	CA3140		7	4	8
U27					
U28	DG508	14	13	8	
U29	LM308		7	4	5
U30	HI-201-5	5,7	14	12	12
U34	MC14042	8	16		3,15,12,10
U37	MC14042		16	8	1,2,9,11
U38	MC14555		16	8	
U39					
U40	LM324		4	11	1,2,3,8,7,10
U41	MC14042		16	8	1,10
U42	MC14042		16	8	3,5,12,15
U43	LM324		4	11	
U44	LM324		4	11	
U45	MC14011		14	7	
U46	MC14028		16	8	4,5,9
U47	MC14042		16	8	9,12,15
U48	MC14042		16	8	3,9,12,15
U49	MC14042		16	8	3,9,12,15
U50	MC14001		14	7	
U51	LM324	9	4	11	
U52	MC14066	9,4	14	7	
U53					
U54	LM393		8	4	
U55	74LS02	7	14		
U56	MC14001		14	7	
U57					
U58	MC1403	3	7		4,5,6,7,8
U59	LM393		8	4	
U60	CA3140		7	4	1,5,8
U61	MC14049		16	8	6,13,14
U62	CA3240		8	4	
U63	CA3240		8	4	
U64	MC14066	12	14	7	10,11
U65	MC1413	3	16	8	

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

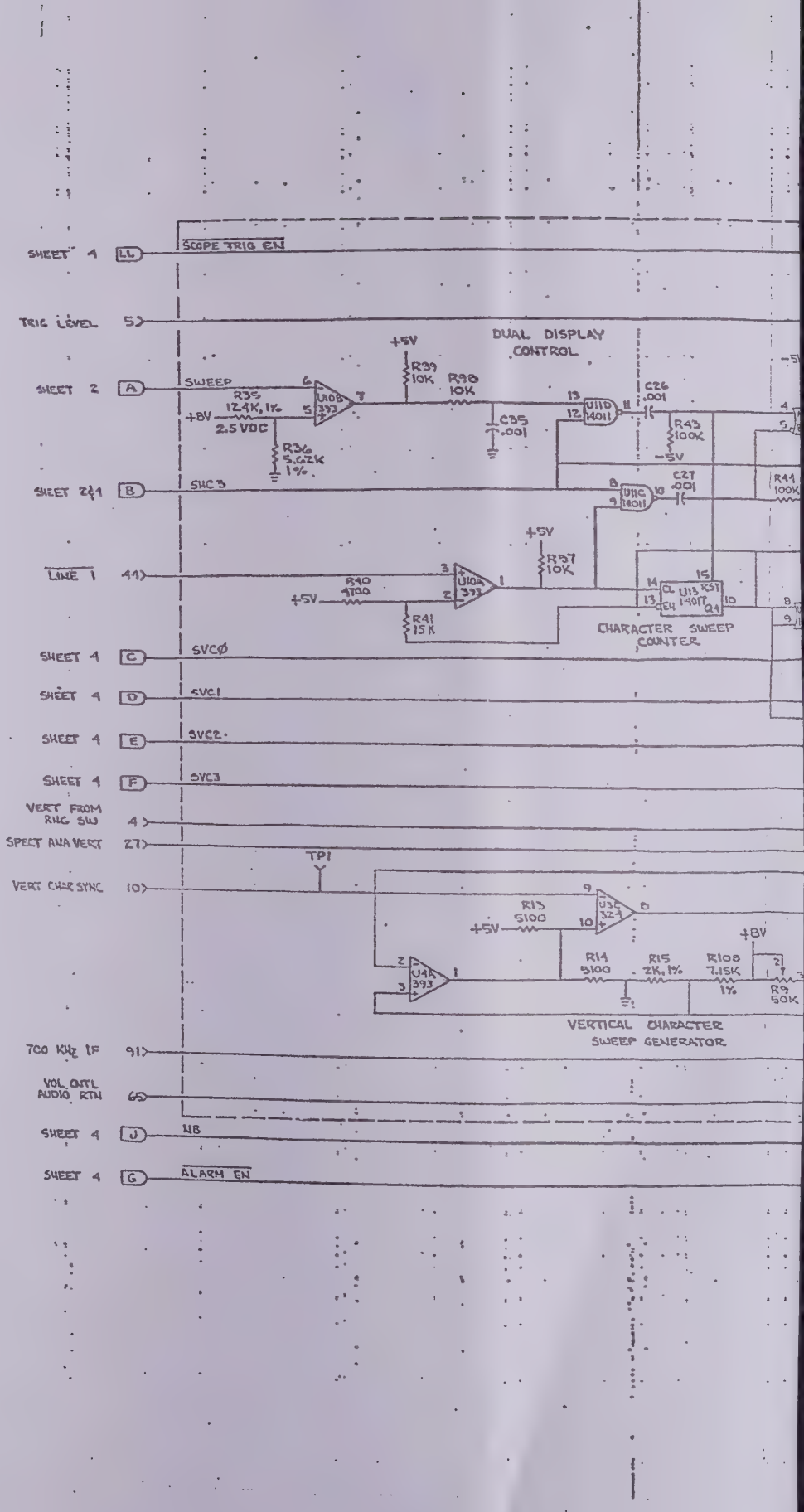
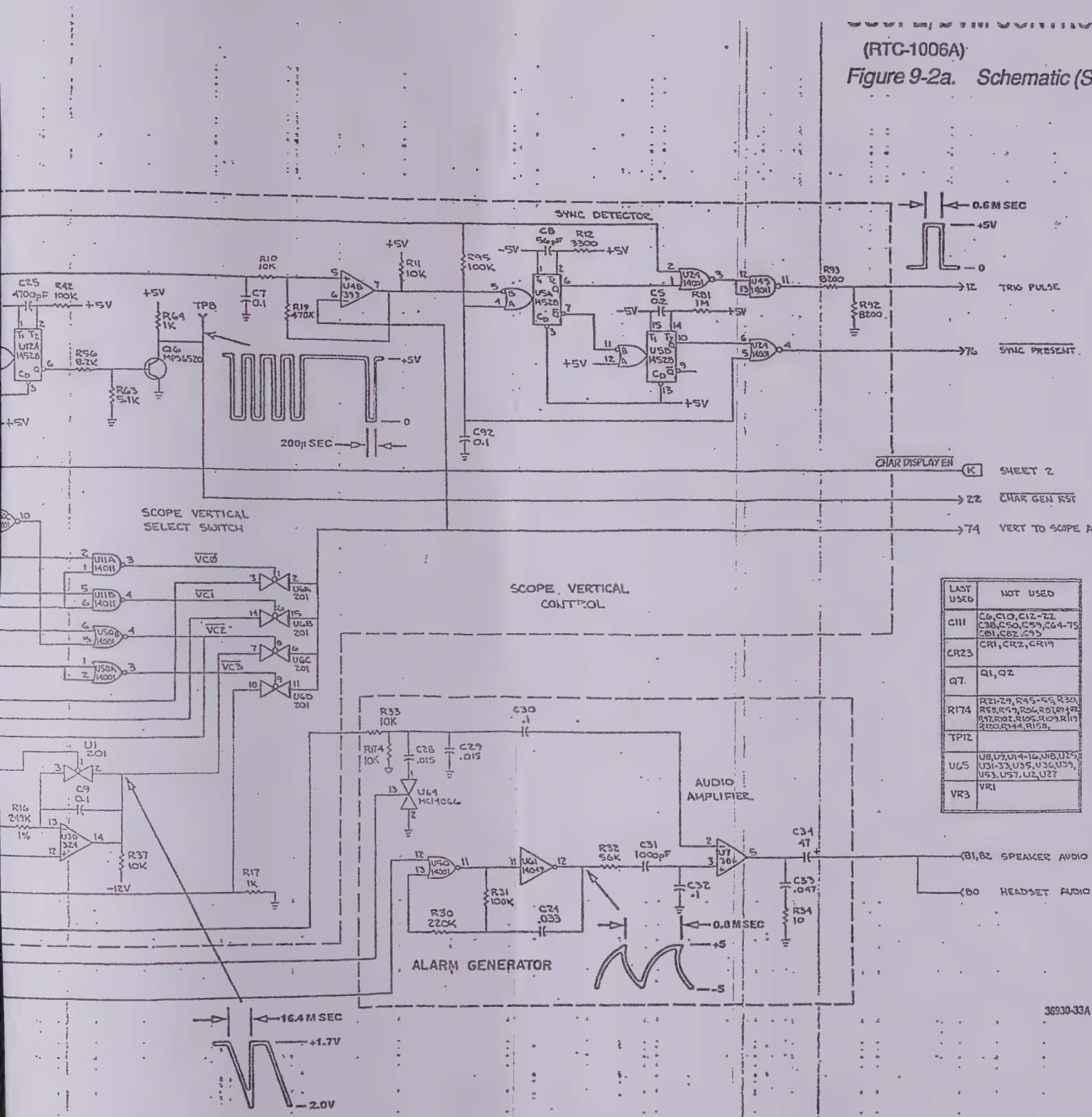


Figure 9-2a. Schematic (Sheet 1 of 4)

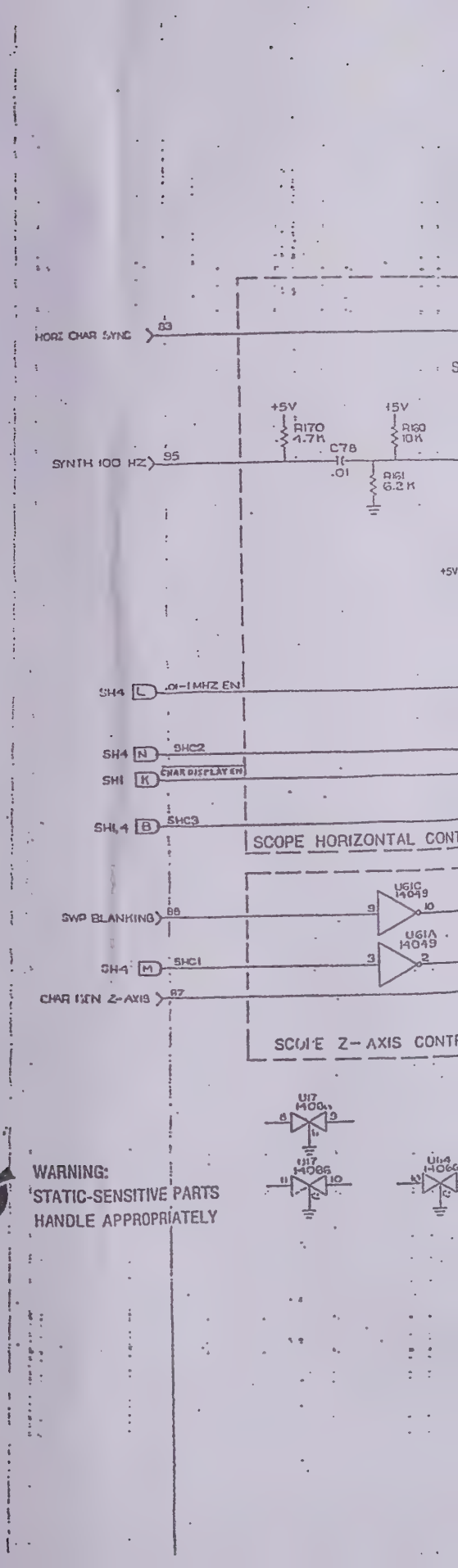


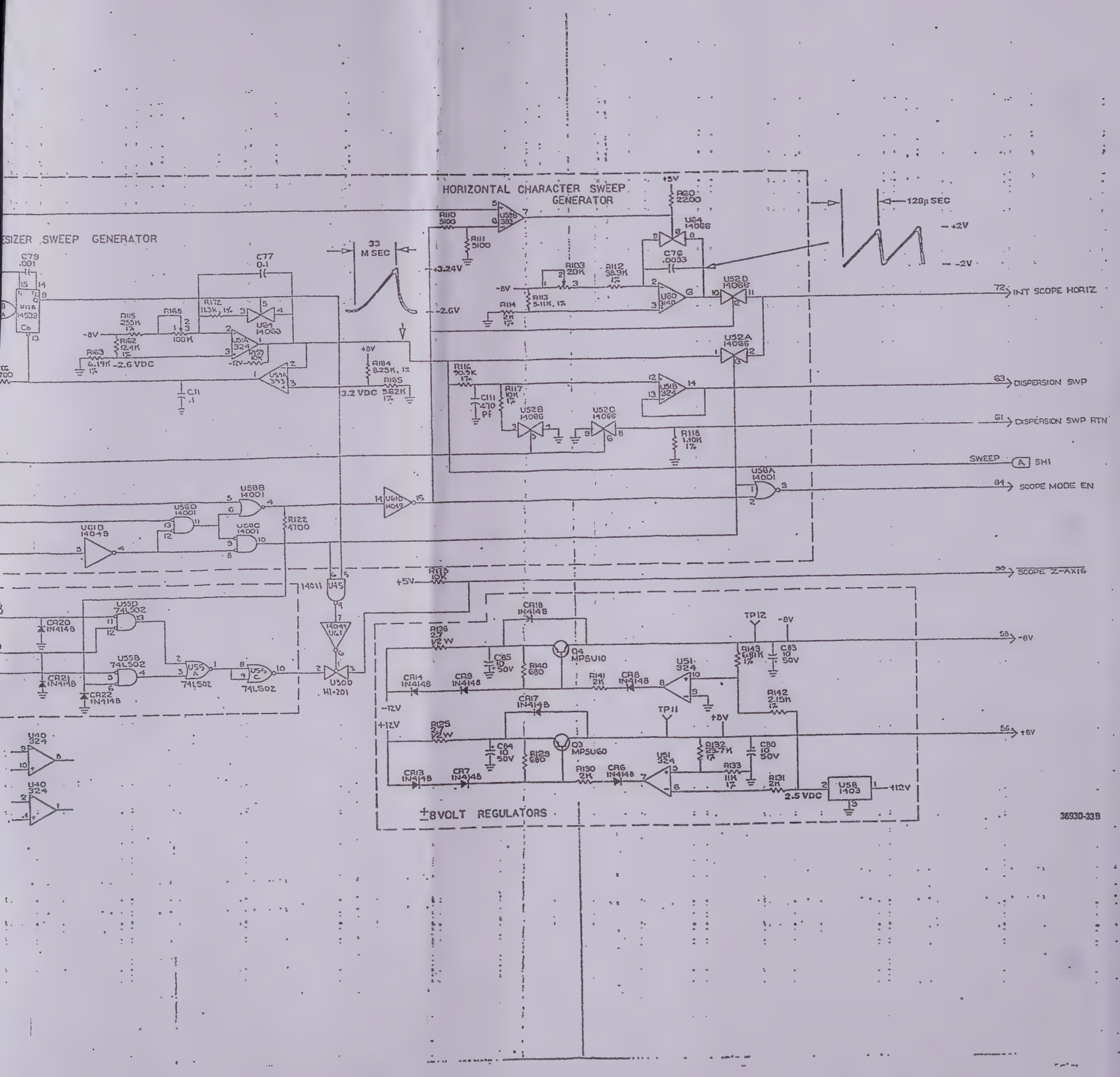
LAST USED	NOT USED
C111	C4,C10,C12-22, C38,C50,C59,C64-75 C81,C82,C93
CR23	CR1,CR2,CR19
Q7	Q1,Q2
R174	R21-29,R45-55,R30, R58,R59,R64,R87,R94,R97,R102,R105,R109,R119 R120,R144,R158,
TP12	
U65	U8,U9,U14-16,U18,U25, U31-33,U35,U36,U39, U53,U57,U2,U27
VR3	VR1

SCOPE/DVM CONTROL BOARD (A7)

(RTC-1006A)

Figure 9-2b. Schematic (Sheet 2 of 4)



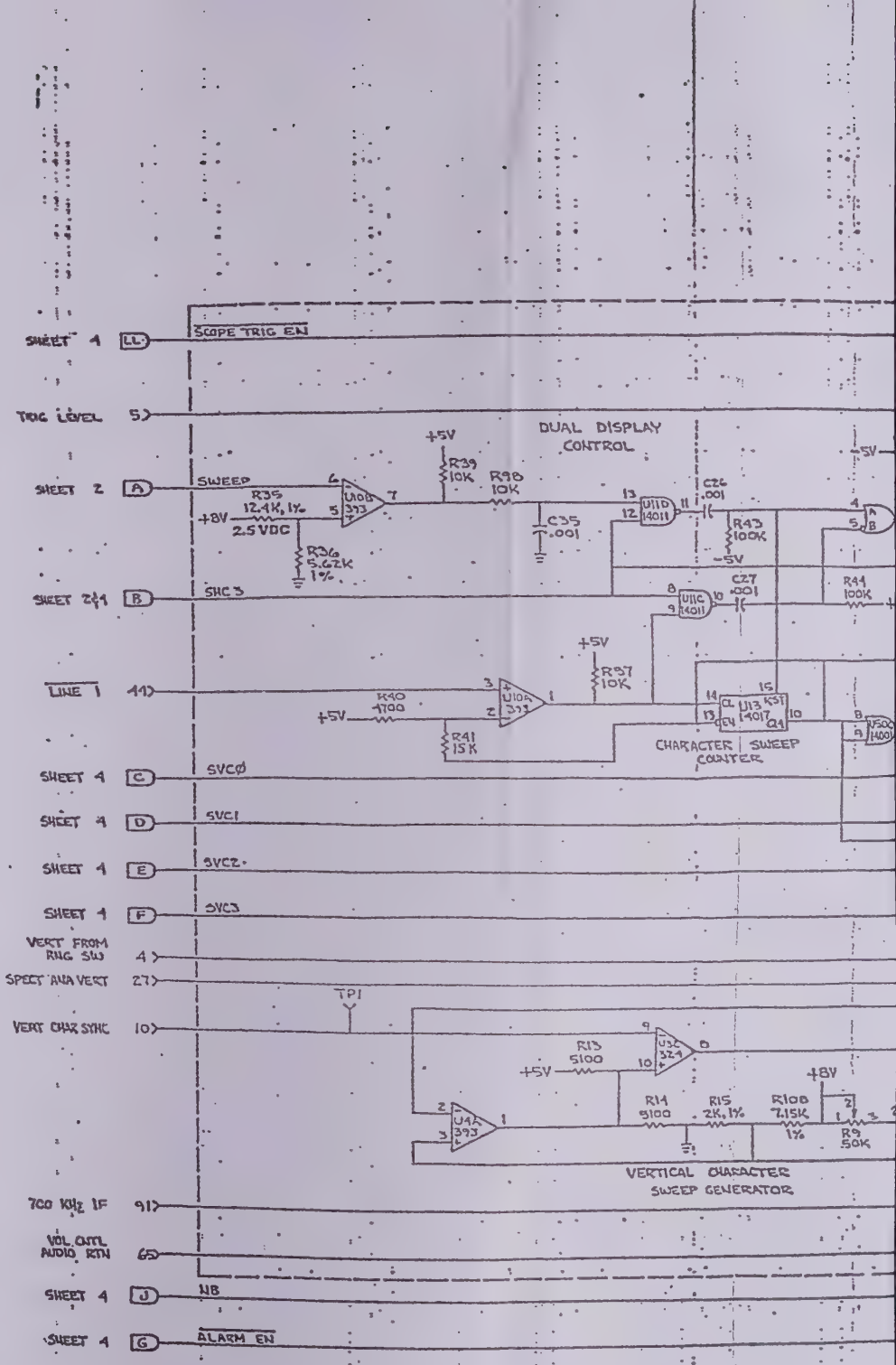

HORIZONTAL CHARACTER SWEEP GENERATOR
ESIZER SWEEP GENERATOR
+5V
R60 2200
U64 14066
C76 .0033
120μ SEC
+2V
-2V
33 M SEC
R110 5100
R111 5100
U59B 393
+3.24V
-2.6V
R103 20K
R112 38.3K 1%
R113 5.11K, 1%
R114 2K 1%
U60 3140
U52D 14066
72 INT SCOPE HORIZ
C79 .001
C77 0.1
U11B 14528
R115 255K 1%
R168
R172 11.3K, 1%
U64 14066
R162 12.4K 1%
100K
-8V
R163 6.19K 1% -2.6 VDC
U59A 324
-12V
U59A 393
+8V
R184 8.25K, 1%
R185 5.62K 1% 3.2 VDC
C11 .1
U52A 14066
R116 90.9K 1%
C111 470 PF
R117 10K 1%
U52B 14066
U52C 14066
U51B 324
63 DISPERSION SWP
61 DISPERSION SWP RTN
R118 1.10K 1%
SWEEP A SHI
U56A 14001
84 SCOPE MODE EN
U56B 14001
U56D 14001
U56C 14001
R122 4700
U61B 14049
U61D 14049
30 SCOPE Z-AXIS
14011 U45
U55D 74LS02
CR20 IN4148
U55B 74LS02
CR21 IN4148
CR22 IN4148
U55A 74LS02
U55C 74LS02
U30D HI-201
R119
+5V
CR18 IN4148
TP12
-8V
58 -8V
R136 2.7 1/2W
C85 10 50V
R140 680
Q4 MPSU10
R143 6.81K 1%
C83 10 50V
CR14 IN4148
CR9 IN4148
R141 2K
CR8 IN4148
U51 324
R142 2.15K 1%
-12V
+12V
CR17 IN4148
TP11
+8V
R125 1/2W
56 +8V
C84 10 50V
R129 680
Q3 MPSU60
R132 23.7K 1%
C80 10 50V
CR13 IN4148
CR7 IN4148
R130 2K
CR6 IN4148
U51 324
R133 11K 1%
R131 2K
2.5 VDC
U58 1403
+12V
±8VOLT REGULATORS
U40 324
U40 324
36930-33B

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH A1A2.
2. FOR REFERENCE DRAWINGS REFER TO ASSY NO. 01-P2208.
3. UNLESS OTHERWISE SPECIFIED
   ALL RESISTORS ARE IN OHMS ± 5% PCT, 1/4 WATTS.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.

REF DES	DEVICE	GND	+V MIN	+V NOM	NO CONNECT
U1	HI-201-5	5,14			12
U2					
U3	MLM324				
U4	LM393				
U5	MC14528				3
U6	HI-201-5	5			12
U7	LM386	6			1,7,8
U8					
U9					
U10	LM393				
U11	MC14011				
U12	MC14528				7,10
U13	MC14017				1-7,9,11,12
U17	MC14066	2,3,6			8,9
U19	CA3160	4			1,5,8
U20	HI-201-5	5			12
U21	CA3140				8
U22	CA3240				
U23	CA3240	2			
U24	MC14001		14	7	
U25					
U26	CA3140				8
U27					
U28	DG508	14			
U29	LM308				5
U30	HI-201-5	5,7			12
U34	MC14042	8			5,15,12,10
U37	MC14042				12,9,11
U38	MC14555				
U39					
U40	LM324				12,3,8,9,10
U41	MC14042				1,10
U42	MC14042				3,9,12,15
U43	LM324				
U44	LM324				
U45	MC14011				
U46	MC14028				4,5,9
U47	MC14042				9,12,15
U48	MC14042				3,9,12,15
U49	MC14042				3,9,12,15
U50	MC14001				
U51	LM324	9			
U52	MC14066	9,4			
U53					
U54	LM393				
U55	74LS02	7			
U56	MC14001				
U57					
U58	MC1403	3			4,5,6,7,8
U59	LM393				
U60	CA3140				1,5,8
U61	MC14049				6,13,16
U62	CA3240				
U63	CA3240				
U64	MC14066	12			10,11
U65	MC1413	3			

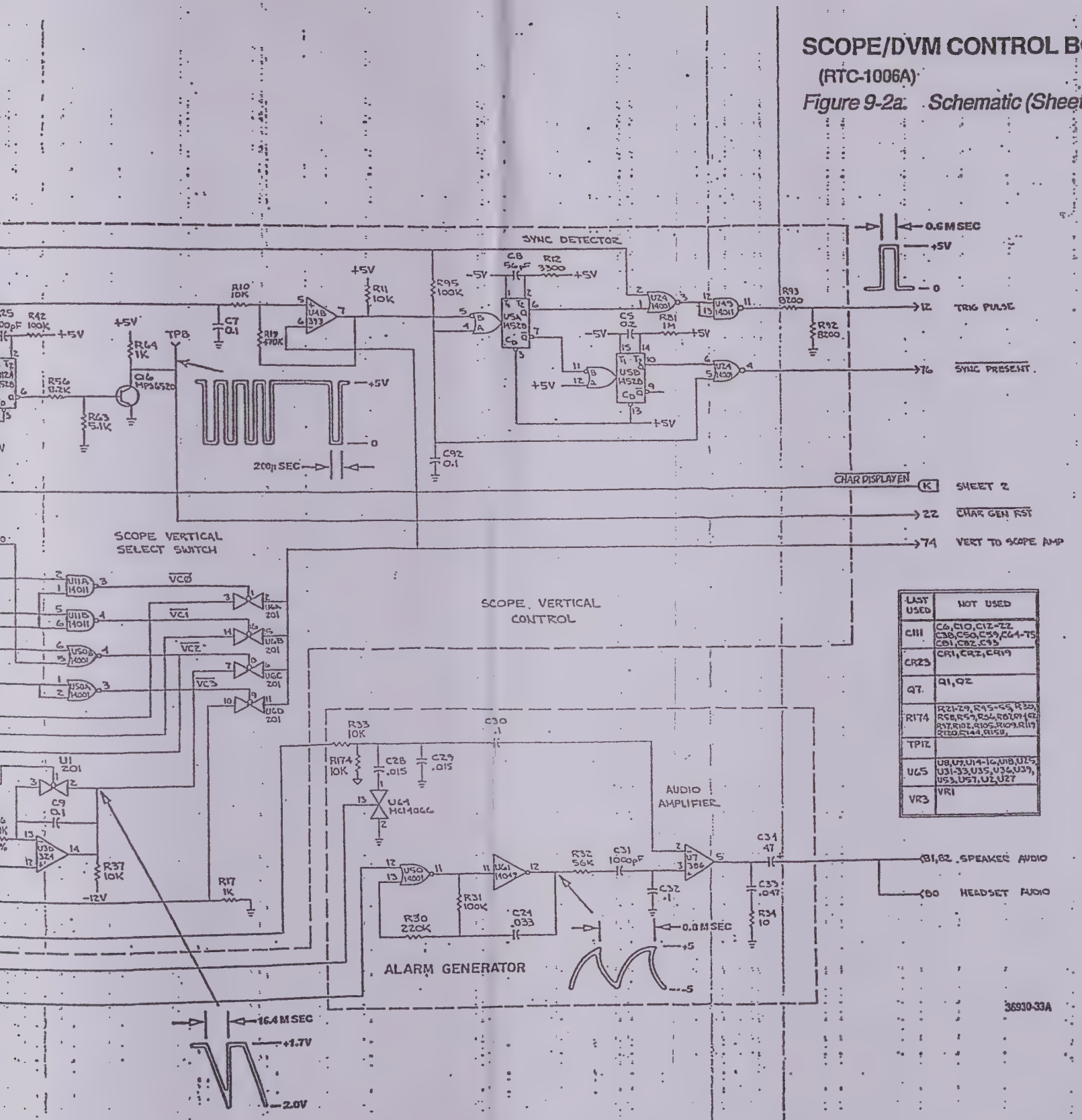
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY



SCOPE/DVM CONTROL BOARD (A7)

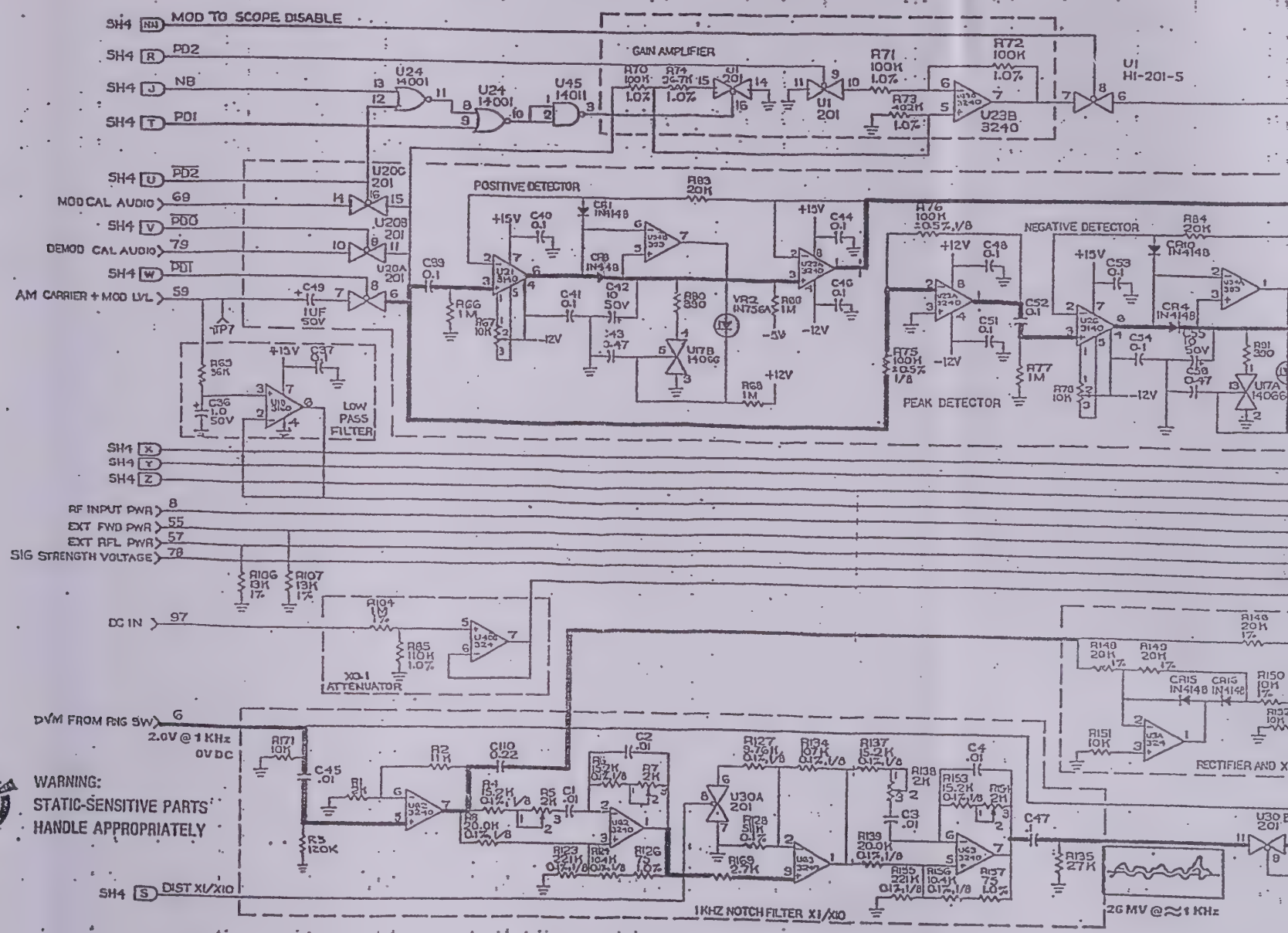
(RTC-1006A)

Figure 9-2a. Schematic (Sheet 1 of 4)



LAST USED	NOT USED
C111	C6, C10, C12-22, C38, C50, C59, C64-75, C81, C82, C93
CR23	CR1, CR2, CR19
Q7	Q1, Q2
R174	R21-29, R45-55, R30, R58, R59, R64, R67, R94, R97, R102, R105, R109, R119, R120, R144, R158,
TP12	
U65	U8, U9, U14-16, U18, U25, U31-33, U35, U36, U39, U53, U57, U2, U27
VR3	VR1

9-8A


SH4 NN MOD TO SCOPE DISABLE
SH4 R PD2
SH4 J NB
SH4 T PDI
GAIN AMPLIFIER
U1 HI-201-5
SH4 U PD2
MOD CAL AUDIO 69
SH4 V PDO
DEMOD CAL AUDIO 79
SH4 W PDI
AM CARRIER + MOD LVL 59
POSITIVE DETECTOR
NEGATIVE DETECTOR
PEAK DETECTOR
LOW PASS FILTER
SH4 X
SH4 Y
SH4 Z
RF INPUT PWR 8
EXT FWD PWR 55
EXT RFL PWR 57
SIG STRENGTH VOLTAGE 78
DC IN 97
X0.1 ATTENUATOR
DVM FROM RIG SW 6
2.0V @ 1 KHz
0V DC
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY
SH4 S DIST X1/X10
1KHZ NOTCH FILTER X1/X10
RECTIFIER AND X
2G MV @≈1 KHz

(RTC-1006A)

Figure 9-2c. Schematic (Sheet 3 of 4)

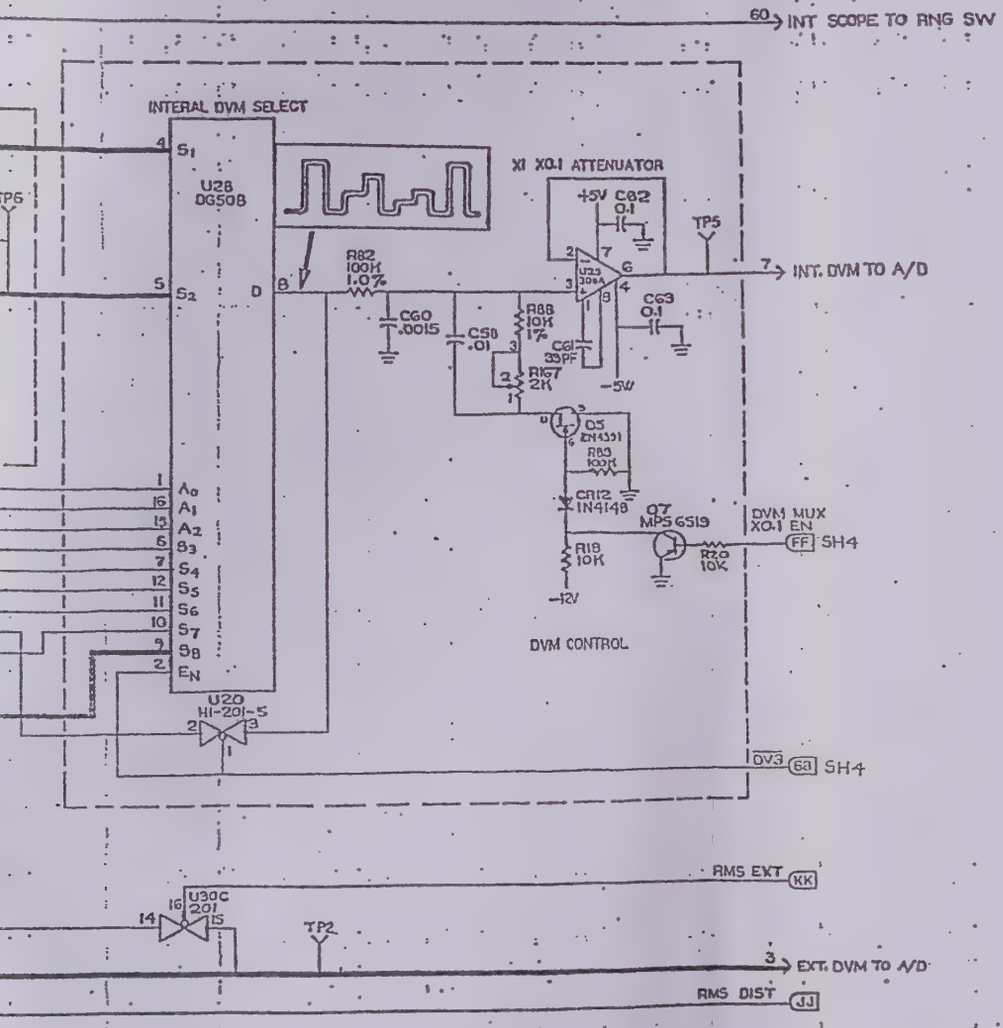
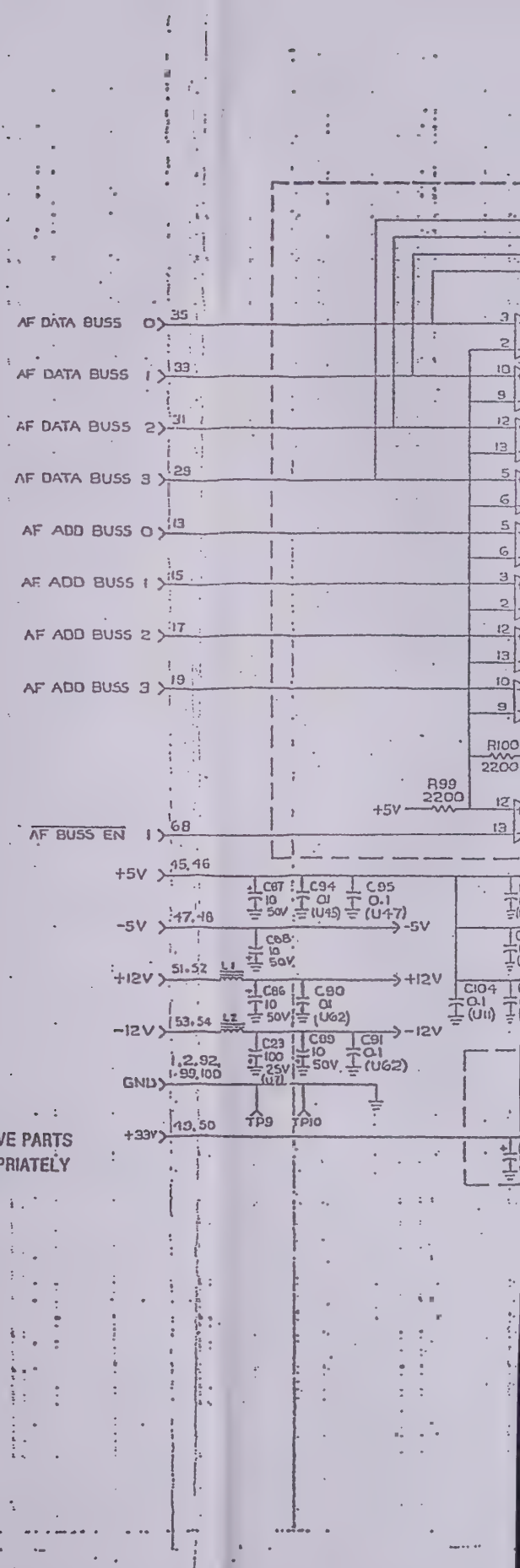
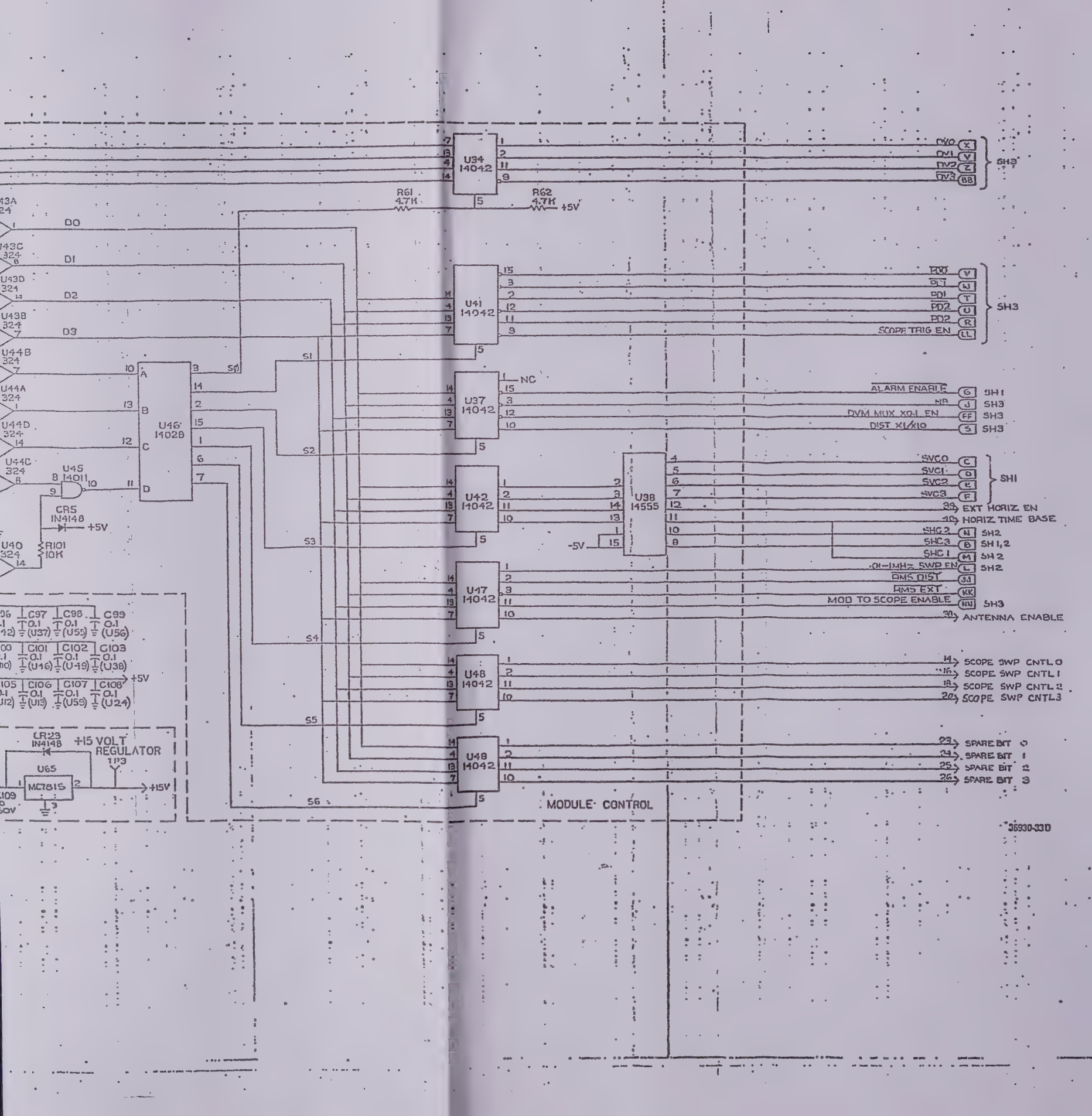
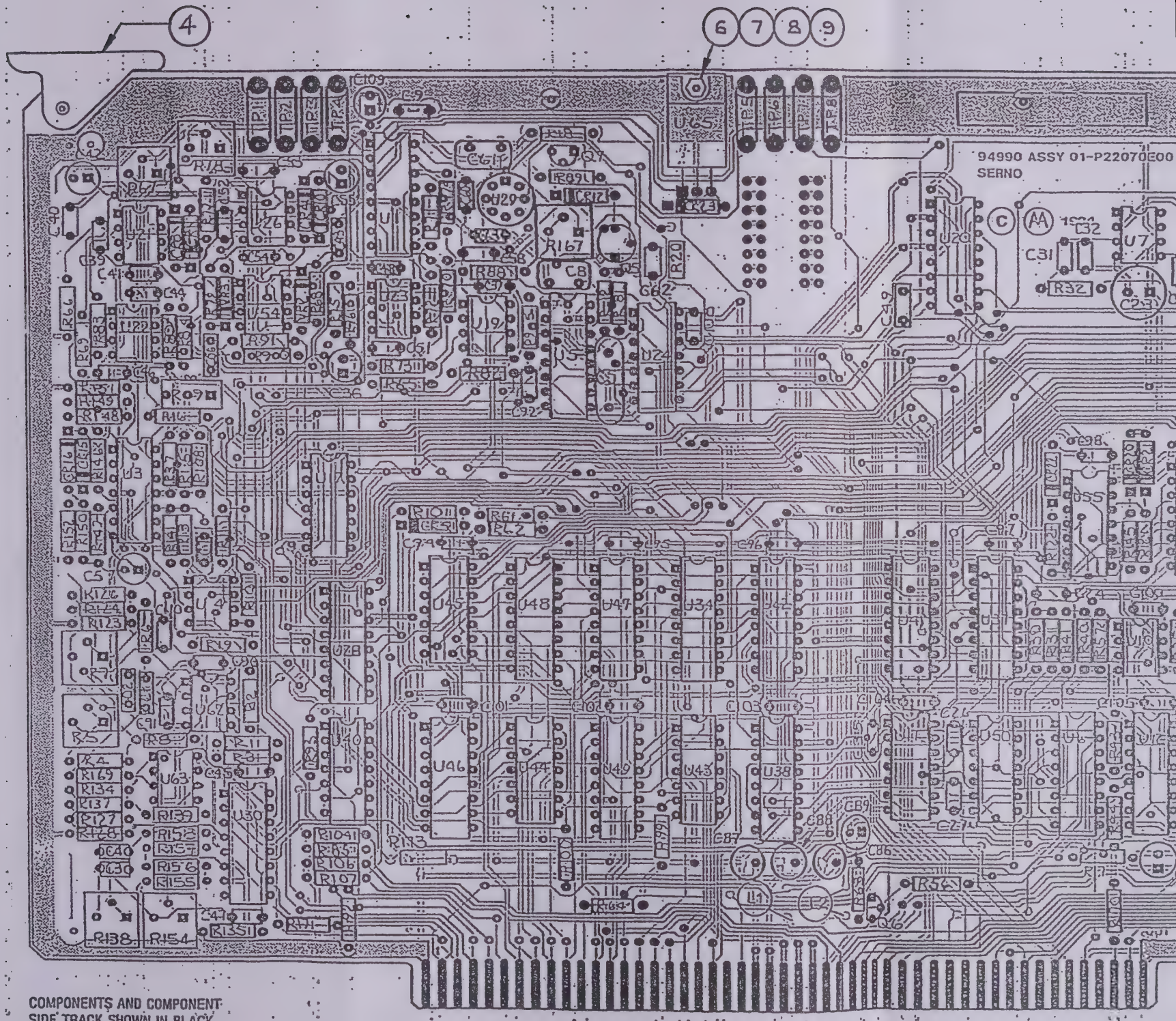


Figure 9-2d. Schematic (Sheet 4 of 4)

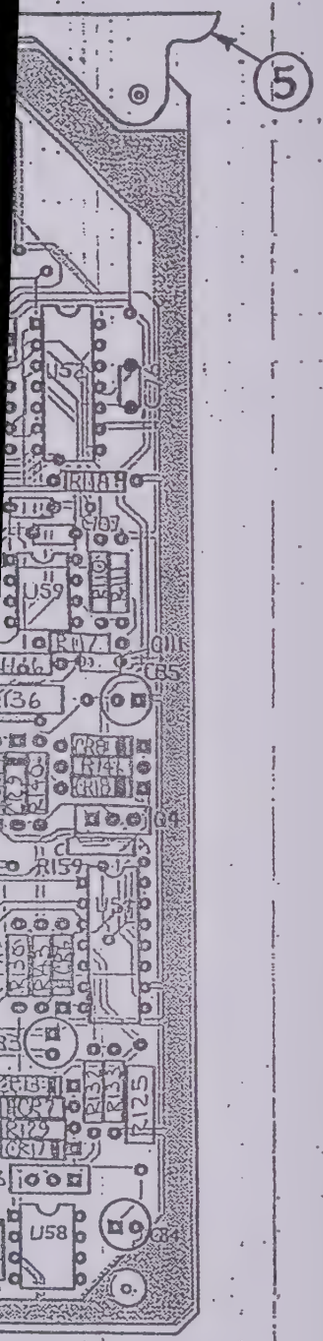


WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY


U34 14042
R61 4.7K
R62 4.7K
+5V
DV0
DV1
DV2
DV3
SH3
D0
D1
D2
D3
U41 14042
PRØ
PD1
PD2
PD2
SCOPE TRIG EN
U44B 324
U44A 324
U44D 324
U44C 324
U45 14011
CR5 IN4148
R101 10K
U46 14028
S0
S1
S2
S3
S4
S5
S6
U37 14042
NC
ALARM ENABLE
DVM MUX X0.1 EN
DIST X1/X10
SH1
SH2
U42 14042
U38 14555
-5V
SVC0
SVC1
SVC2
SVC3
EXT HORIZ EN
HORIZ TIME BASE
SHC2
SHC3
SHC1
.01–1MHz SWP EN
DMS DIST
DMS EXT
MOD TO SCOPE ENABLE
ANTENNA ENABLE
U47 14042
U48 14042
SCOPE SWP CNTL 0
SCOPE SWP CNTL 1
SCOPE SWP CNTL 2
SCOPE SWP CNTL 3
SPARE BIT 0
SPARE BIT 1
SPARE BIT 2
SPARE BIT 3
C96 C97 C98 C99
C100 C101 C102 C103
C105 C106 C107 C108
0.1
(U37) (U55) (U56)
(U46) (U49) (U38)
(U13) (U59) (U24)
CR23 IN4148
+15 VOLT REGULATOR
U65
MC7815
TP3
+15V
MODULE CONTROL
36930-33D



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.



SCOPE/DVM CONTROL BOARD (A7)
RTC-1006A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
004	1	45-80339B28	CARD EJECTOR	
005	1	45-80339B40	CARD EJECTOR	MARKED
006	1	03-139599	SCREW	.112-40X.312
007	1	04-140358	WASHER	.112
008	1	04-9777	WASHER, LOCK	.112
009	1	02-140125	NUT, LIGHT HEX	.112-40
C001	1	21-80342B32	CAPACITOR	.01UF-S-50
C002	1	21-80342B32	CAPACITOR	.01UF-S-50
C003	1	21-80342B32	CAPACITOR	.01UF-S-50
C004	1	21-80342B32	CAPACITOR	.01UF-S-50
C005	1	21-82372C05	CAPACITOR	.2UF+80-20-25
C007	1	21-80342B10	CAPACITOR	.1UF-20-50
C008	1	21-80339B17	CAPACITOR	56PF-S-500
C009	1	21-80341B96	CAPACITOR	.1UF-10-100
C011	1	21-80341B96	CAPACITOR	.1UF-10-100
C023	1	23-84665F03	CAPACITOR	100UF-20-25
C024	1	21-80342B02	CAPACITOR	.033UF-10-100
C025	1	21-80342B05	CAPACITOR	4700PF-10-100
C026	1	21-80341B92	CAPACITOR	1000PF-10-100
C027	1	21-80341B92	CAPACITOR	1000PF-10-100
C028	1	21-80342B04	CAPACITOR	.015UF-10-100
C029	1	21-80342B04	CAPACITOR	.015UF-10-100
C030	1	21-80342B10	CAPACITOR	.1UF-20-50
C031	1	21-80341B92	CAPACITOR	1000PF-10-100
C032	1	21-80341B96	CAPACITOR	.1UF-10-100
C033	1	21-80342B13	CAPACITOR	.047UF-20-50
C034	1	23-84665F25	CAPACITOR	47UF-20-10
C035	1	21-80341B92	CAPACITOR	1000PF-10-100
C036	1	23-83441B15	CAPACITOR	1UF-20-35
C037	1	21-80342B10	CAPACITOR	.1UF-20-50
C039	1	21-80342B10	CAPACITOR	.1UF-20-50
C040	1	21-80342B10	CAPACITOR	.1UF-20-50
C041	1	21-80342B10	CAPACITOR	.1UF-20-50
C042	1	23-80341B15	CAPACITOR	10UF-20-50
C043	1	21-80342B45	CAPACITOR	.47UF-10-50
C044	1	21-80342B10	CAPACITOR	.1UF-20-50
C045	1	21-80342B09	CAPACITOR	.01UF-20-50
C046	1	21-80342B10	CAPACITOR	.1UF-20-50
C047	1	21-80342B10	CAPACITOR	.1UF-20-50
C048	1	21-80342B10	CAPACITOR	.1UF-20-50
C049	1	21-80342B46	CAPACITOR	1UF-20-50
C051	1	21-80342B10	CAPACITOR	.1UF-20-50
C052	1	21-80342B10	CAPACITOR	.1UF-20-50
C053	1	21-80342B10	CAPACITOR	.1UF-20-50
C054	1	21-80342B10	CAPACITOR	.1UF-20-50
C055	1	23-80341B15	CAPACITOR	10UF-20-50
C056	1	21-80342B45	CAPACITOR	.47UF-10-50
C057	1	23-80341B15	CAPACITOR	10UF-20-50
C058	1	21-80341B94	CAPACITOR	.01UF-10-100
C060	1	21-80341B56	CAPACITOR	1500PF-10-50
C061	1	21-80339B15	CAPACITOR	39PF-S-500
C062	1	21-80342B10	CAPACITOR	.1UF-20-50
C063	1	21-80342B10	CAPACITOR	.1UF-20-50
C076	1	21-80341B71	CAPACITOR	3300PF-S-50
C077	1	08-80343B12	CAPACITOR	.1UF-10-100
C078	1	21-80342B09	CAPACITOR	.01UF-20-50
C079	1	21-80341B46	CAPACITOR	1000PF-S-50
C080	1	23-80341B15	CAPACITOR	10UF-20-50
C083	1	23-80341B15	CAPACITOR	10UF-20-50
C084	1	23-80341B15	CAPACITOR	10UF-20-50
C085	1	23-80341B15	CAPACITOR	10UF-20-50
C086	1	23-80341B15	CAPACITOR	10UF-20-50
C087	1	23-80341B15	CAPACITOR	10UF-20-50
C088	1	23-80341B15	CAPACITOR	10UF-20-50
C089	1	23-80341B15	CAPACITOR	10UF-20-50
C090	1	21-80342B10	CAPACITOR	.1UF-20-50
C091	1	21-80342B10	CAPACITOR	.1UF-20-50
C092	1	21-80342B10	CAPACITOR	.1UF-20-50
C094	1	21-80342B10	CAPACITOR	.1UF-20-50
C095	1	21-80342B10	CAPACITOR	.1UF-20-50
C096	1	21-80342B10	CAPACITOR	.1UF-20-50
C097	1	21-80342B10	CAPACITOR	.1UF-20-50
C098	1	21-80342B10	CAPACITOR	.1UF-20-50
C099	1	21-80342B10	CAPACITOR	.1UF-20-50
C100	1	21-80342B10	CAPACITOR	.1UF-20-50
C101	1	21-80342B10	CAPACITOR	.1UF-20-50
C102	1	21-80342B10	CAPACITOR	.1UF-20-50
C103	1	21-80342B10	CAPACITOR	.1UF-20-50
C104	1	21-80342B10	CAPACITOR	.1UF-20-50
C105	1	21-80342B10	CAPACITOR	.1UF-20-50
C106	1	21-80342B10	CAPACITOR	.1UF-20-50
C107	1	21-80342B10	CAPACITOR	.1UF-20-50
C108	1	21-80342B10	CAPACITOR	.1UF-20-50

SCOPE/DVM CONTROL BOARD (A7)
(RTC-1006A)

Figure 9-3. Printed Wiring Board Assembly and Parts List

SCOPE/DVM CONTROL BOARD (A7) (Cont)
RTC-1006A

Find No.	Qty. Reg.	Part No.	Nomenclature	Part Value
C109	1	23-80341B15	CAPACITOR	10UF-20-50
C110	1	21-80342B11	CAPACITORQ	.22UF-20-50
C111	1	21-80341B62	CAPACITOR	470PF-5-50
CR003	1	48-84463K02	DIODE	
CR004	1	48-84463K02	DIODE	
CR005	1	48-84463K02	DIODE	
CR006	1	48-84463K02	DIODE	
CR007	1	48-84463K02	DIODE	
CR008	1	48-84463K02	DIODE	
CR009	1	48-84463K02	DIODE	
CR010	1	48-84463K02	DIODE	
CR011	1	48-84463K02	DIODE	
CR012	1	48-84463K02	DIODE	
CR013	1	48-84463K02	DIODE	
CR014	1	48-84463K02	DIODE	
CR015	1	48-84463K02	DIODE	
CR016	1	48-84463K02	DIODE	
CR017	1	48-84463K02	DIODE	
CR018	1	48-84463K02	DIODE	
CR020	1	48-84463K02	DIODE	
CR021	1	48-84463K02	DIODE	
CR022	1	48-84463K02	DIODE	
CR023	1	48-84463K02	DIODE	
L001	1	25-80342B79	COIL,TOROID	
L002	1	25-80342B79	COIL,TOROID	
Q003	1	48-80341A48	TRANSISTOR	MPS-U60 SCREENED
Q004	1	48-80341A47	TRANSISTOR	MPS-U10 SCREENED
Q005	1	48-80343B21	TRANSISTOR	2N4391 SCREENED
Q006	1	48-80340B86	TRANSISTOR	MPS6520
Q007	1	48-80340B85	TRANSISTOR	MPS6519
R001	1	06-11009C56	RESISTOR	2K-5-1/4
R002	1	06-11009C74	RESISTOR	11K-5-1/4
R003	1	06-11009C99	RESISTOR	120K-5-1/4
R004	1	06-80396A63	RESISTOR	15.2K-1-1/8
R005	1	18-83452F02	RESISTOR,VARIABLE	2K
R006	1	06-80396A63	RESISTOR	15.2K-1-1/8
R007	1	18-83452F02	RESISTOR,VARIABLE	2K
R008	1	06-80396A64	RESISTOR	20K-1-1/8
R009	1	18-83452F17	RESISTOR,VARIABLE	50K
R010	1	06-11009C73	RESISTOR	10K-5-1/4
R011	1	06-11009C73	RESISTOR	10K-5-1/4
R012	1	06-11009C61	RESISTOR	3.3K-5-1/4
R013	1	06-11009C66	RESISTOR	5.1K-5-1/4
R014	1	06-11009C66	RESISTOR	5.1K-5-1/4
R015	1	06-10621C24	RESISTOR	2K-1-1/4
R016	1	06-10621E27	RESISTOR	249K-1-1/4
R017	1	06-11009C49	RESISTOR	1K-5-1/4
R018	1	06-11009C73	RESISTOR	10K-5-1/4
R019	1	5043CX470K0J	RESISTOR	470K-5-1/4
R020	1	06-11009C73	RESISTOR	10K-5-1/4
R030	1	06-11009D06	RESISTOR	220K-5-1/4
R031	1	06-11009C97	RESISTOR	100K-5-1/4
R032	1	06-11009C91	RESISTOR	56K-5-1/4
R033	1	06-11009C73	RESISTOR	10K-5-1/4
R034	1	06-11009C01	RESISTOR	10-5-1/4
R035	1	06-10621D01	RESISTOR	12.4K-1-1/4
R036	1	06-10621C67	RESISTOR	5.62K-1-1/4
R037	1	06-11009C73	RESISTOR	10K-5-1/4
R039	1	06-121009C73	RESISTOR	10K-5-1/4
R040	1	06-11009C65	RESISTOR	4.7K-5-1/4
R041	1	06-11009C77	RESISTOR	15K-5-1/4
R042	1	06-11009C97	RESISTOR	100K-5-1/4
R043	1	06-11009C97	RESISTOR	100K-5-1/4
R044	1	06-11009C97	RESISTOR	100K-5-1/4
R056	1	06-11009C71	RESISTOR	8.2K-5-1/4
R057	1	06-11009C73	RESISTOR	10K-5-1/4
R060	1	06-11009C57	RESISTOR	2.2K-5-1/4
R061	1	06-11009C65	RESISTOR	4.7K-5-1/4
R062	1	06-11009C65	RESISTOR	4.7K-5-1/4
R063	1	06-11009C66	RESISTOR	5.1K-5-1/4
R064	1	06-11009C49	RESISTOR	1K-5-1/4
R065	1	06-11009C86	RESISTOR	36K-5-1/4
R066	1	06-11009D22	RESISTOR	1M-5-1/4
R067	1	18-83452F14	RESISTOR,VARIABLE	10K
R068	1	06-11009d22	RESISTOR	1M-5-1/4
R069	1	06-11009D22	RESISTOR	1M-5-1/4
R070	1	06-10621D88	RESISTOR	100K-1-1/4
R071	1	06-10621D88	RESISTOR	100K-1-1/4
R072	1	06-10621D88	RESISTOR	100K-1-1/4
R073	1	06-10621E47	RESISTOR	402K-1-1/4
R074	1	06-10621D33	RESISTOR	26.7K-1-1/4
R075	1	06-80396A58	RESISTOR	100K-0.5-1/8
R076	1	06-80396A58	RESISTOR	100K-0.5-1/8
R077	1	06-11009D22	RESISTOR	1M-5-1/4
R078	1	18-83452F14	RESISTOR,VARIABLE	10K

Find No.	Qty. Reg.
R079	1
R080	1
R081	1
R082	1
R083	1
R084	1
R085	1
R086	1
R087	1
R088	1
R089	1
R090	1
R091	1
R092	1
R093	1
R094	1
R095	1
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R165	1
R166	1
R167	1
R168	1
R169	1
R170	1
R171	1
R172	1
R173	1
R174	1
TP001	1

Part No.	Nomenclature	Part Value
6-11009D22	RESISTOR	1M-5-1/4
6-11009D22	RESISTOR	1M-5-1/4
6-11009D22	RESISTORQ	1M-5-1/4
6-10621D88	RESISTOR	100K-1-1/4
6-11009C80	RESISTOR	20K-5-1/4
6-11009C80	RESISTOR	20K-5-1/4
6-10621D92	RESISTOR	110K-1-1/4
6-10621C91	RESISTOR	10K-1-1/4
6-11009C97	RESISTOR	100K-5-1/4
6-11009C39	RESISTORS	390-5-1/4
6-11009C39	RESISTORS	390-5-1/4
6-11009C71	RESISTOR	8.2K-5-1/4
6-11009C71	RESISTOR	8.2K-5-1/4
6-11009C97	RESISTOR	100K-5-1/4
6-11009C73	RESISTOR	10K-5-1/4
6-11009C57	RESISTOR	2.2K-5-1/4
6-11009C57	RESISTOR	2.2K-5-1/4
6-11009C73	RESISTOR	10K-5-1/4
18-83452F15	RESISTOR,VARIABLE	20K
6-10621E85	RESISTOR	1M-1-1/4
6-10621D03	RESISTOR	13K-1-1/4
6-10621D03	RESISTOR	13K-1-1/4
6-10621C77	RESISTOR	7.15K-1-1/4
6-11009C66	RESISTOR	5.1K-5-1/4
6-11009C66	RESISTOR	5.1K-5-1/4
6-10621D48	RESISTOR	38.3K-1-1/4
6-10621C63	RESISTOR	5.11K-1-1/4
6-10621C24	RESISTOR	2K-1-1/4
6-10621E28	RESISTOR	255K-1-1/4
6-10621D84	RESISTOR	90.9K-1-1/4
6-10621C91	RESISTOR	10K-1-1/4
6-10621B98	RESISTOR	1.1K-1-1/4
6-11009C65	RESISTOR	4.7K-5-1/4
6-11009C65	RESISTOR	4.7K-5-1/4
6-80396A65	RESISTOR	221K-1-1/8
6-80396A61	RESISTOR	10.4K-1-1/8
6-80037G11	RESISTOR	2.7-5-1/2
6-10621A85	RESISTOR	75-1-1/4
6-80396A72	RESISTOR	9.76K-1-1/8
6-80396A68	RESISTOR	511K-1-1/8
6-11009C45	RESISTOR	680-5-1/4
6-11009C56	RESISTOR	2K-5-1/4
6-11009C56	RESISTOR	2K-5-1/4
6-10621D28	RESISTOR	23.7K-1-1/4
6-10621C95	RESISTOR	11K-1-1/4
6-80396A62	RESISTOR	107K-1-1/8
6-11009C83	RESISTOR	27K-5-1/4
6-80037G11	RESISTOR	2.7-5-1/2
6-80396A63	RESISTOR	15.2K-1-1/8
18-83452F02	RESISTOR,VARIABLE	2K
6-80396A64	RESISTOR	20K-1-1/8
6-11009C45	RESISTOR	680-5-1/4
6-11009C56	RESISTOR	2K-5-1/4
6-10621C27	RESISTOR	2.15K-1-1/4
6-10621C75	RESISTOR	6.81K-1-1/4
6-11009C65	RESISTOR	4.7K-5-1/4
6-10621D21	RESISTOR	20K-1-1/4
6-10621D25	RESISTOR	22.1K-1-1/4
6-10621D21	RESISTOR	20K1-1-1/4
6-10621D21	RESISTOR	20K-1-1/4
6-10621C91	RESISTOR	10K-1-1/4
6-11009C73	RESISTOR	10K-5-1/4
6-11009C73	RESISTOR	10K-5-1/4
6-80396A63	RESISTOR	15.2K-1-1/8
18-83452F02	RESISTOR,VARIABLE	2K
6-80396A65	RESISTOR	221K-1-1/8
6-80396A61	RESISTOR	10.4K-1-1/8
6-10621A85	RESISTOR	75-1-1/4
6-185A73	RESISTOR	10K-5-1/8
6-11009C73	RESISTOR	10K-5-1/4
6-11009C68	RESISTOR	6.2K-5-1/4
6-10621D01	RESISTOR	12.4K-1-1/4
6-10621C71	RESISTOR	6.19K-1-1/4
6-10621C83	RESISTOR	8.25K-1-1/4
6-10621C67	RESISTOR	5.62K-1-1/4
6-11009C65	RESISTOR	4.7K-5-1/4
18-83452F02	RESISTOR,VARIABLE	2K
18-83452F19	RESISTOR,VARIABLE	100K
6-11009C59	RESISTOR	2.7K-5-1/4
6-11009C65	RESISTOR	4.7K-5-1/4
6-11009C73	RESISTOR	10K-5-1/4
6-10621C95	RESISTOR	11.3K-1-1/4
6-11009C73	RESISTOR	10K-5-1/4
6-11009C73	RESISTOR	10K-5-1/4
09-80331A88	JACK	WHITE

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
TP005	1	09-80331A88	JACK	WHITE
TP006	1	09-80331A88	JACK	WHITE
TP007	1	09-80331A88	JACK	WHITE
TP008	1	09-80331A88	JACK	WHITE
TP009	1	90-80331A88	JACK	WHITE
TP010	1	09-80331A88	JACK	WHITE
TP011	1	09-80331A88	JACK	WHITE
TP012	1	09-803311A88	JACK	WHITE
U001	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U003	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U004	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
U005	1	51-82884L28	INTEGRATED CIRCUIT	
U006	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U007	1	51-80345A09	AUDIO AMP	LM386N-1 SCREENED
U010	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
U011	1	51-05596E46	INTEGRATED CIRCUIT	
U012	1	51-82884L28	INTEGRATED CIRCUIT	
U013	1	51-82884L35	INTEGRATED CIRCUIT	
U017	1	51-82884L71	INTEGRATED CIRCUIT	
U019	1	51-80345A02	INTEGRATED CIRCUIT	CA3160E SCREENED
U020	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U021	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U022	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U023	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U024	1	51-05126M33	INTEGRATED CIRCUIT	
U026	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U028	1	51-80396A13	INTEGRATED CIRCUIT	DG508CJ SCREENED
U029	1	51-80340B02	INTEGRATED CIRCUIT	
U030	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U034	1	51-82884L15	INTEGRATED CIRCUIT	
U037	1	51-82994L15	INTEGRATED CIRCUIT	
U038	1	51-80252D01	INTEGRATED CIRCUIT	
U040	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U041	1	51-82884L15	INTEGRATED CIRCUIT	
U042	1	51-82884L15	INTEGRATED CIRCUIT	
U043	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U044	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U045	1	51-05596E46	INTEGRATED CIRCUIT	
U046	1	51-82884L09	INTEGRATED CIRCUIT	
U047	1	51-82884L15	INTEGRATED CIRCUIT	
U048	1	51-82884L15	INTEGRATED CIRCUIT	
U049	1	51-82884L15	INTEGRATED CIRCUIT	
U050	1	51-05126M33	INTEGRATED CIRCUIT	
U051	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U052	1	51-82884L71	INTEGRATED CIRCUIT	
U054	1	51-8345A10	INTEGRATED CIRCUIT	LM393N SCREENED
U055	1	51-84561L06	INTEGRATED CIRCUIT	
U056	1	51-05126M33	INTEGRATED CIRCUIT	
U058	1	51-05469E13	INTEGRATED CIRCUIT	
U059	1	51-80345A10	INTEGRATED CIRCUIT	LM393N SCREENED
U060	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U061	1	51-82884L02	INTEGRATED CIRCUIT	
U062	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U063	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U064	1	51-82884L71	INTEGRATED CIRCUIT	
U065	1	51-83629M28	INTEGRATED CIRCUIT	
VR002	1	48-83461E32	DIODE,ZENER	8.2V-5-.5
VR003	1	48-83461E32	DIODE,ZENER	8.2V-5-.5

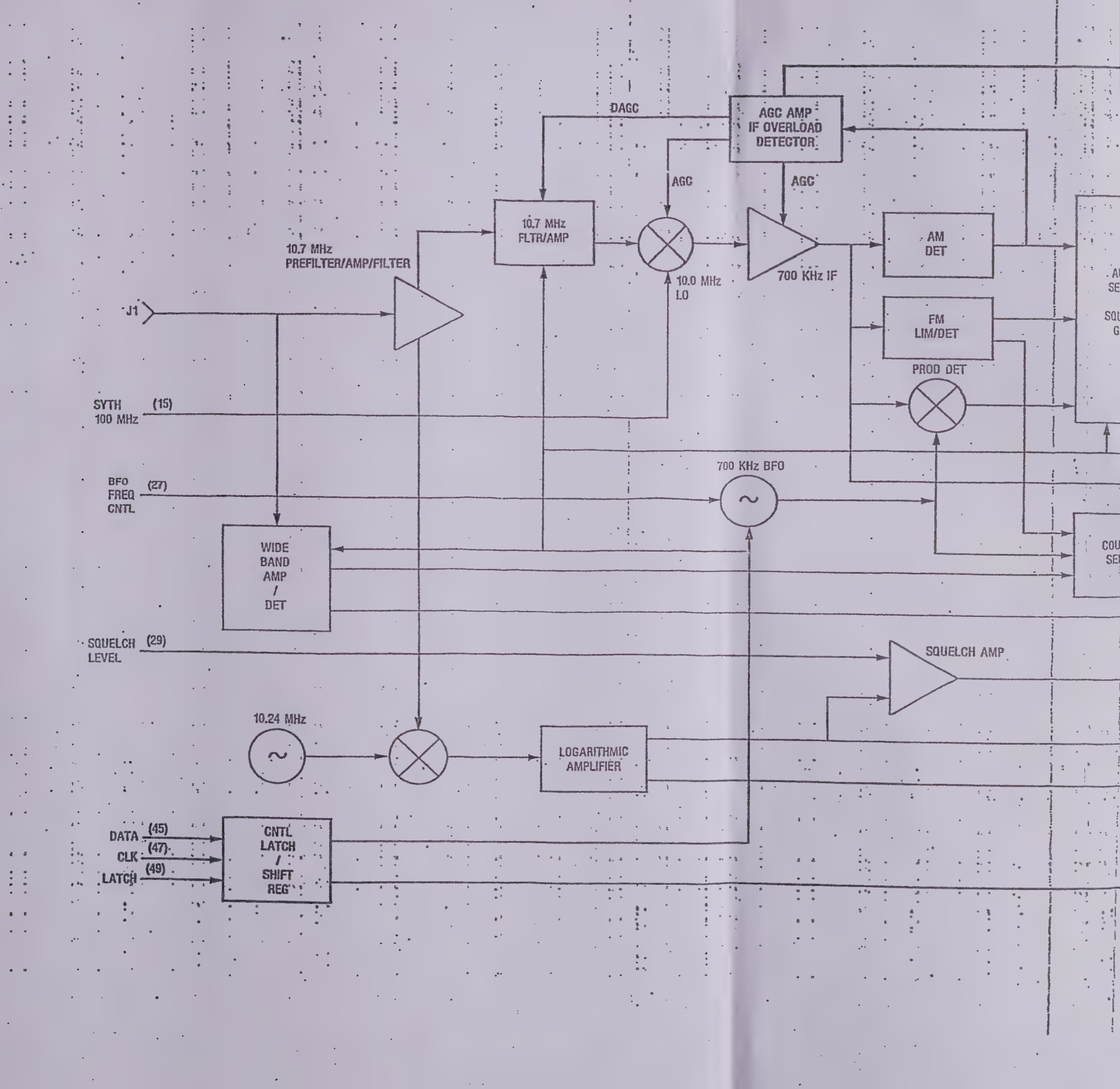

DAGC
AGC AMP
IF OVERLOAD
DETECTOR
AGC
AGC
10.7 MHz
FLTR/AMP
10.7 MHz
PREFILTER/AMP/FILTER
10.0 MHz
LO
700 KHz IF
AM
DET
FM
LIM/DET
PROD DET
J1
SYTH
100 MHz
(15)
700 KHz BFO
BFO
FREQ
CNTL
(27)
WIDE
BAND
AMP
/
DET
SQUELCH
LEVEL
(29)
SQUELCH AMP
10.24 MHz
LOGARITHMIC
AMPLIFIER
DATA
(45)
CLK
(47)
LATCH
(49)
CNTL
LATCH
/
SHIFT
REG

Figure 10-1a. Block Diagram (Sheet 1 of 4)

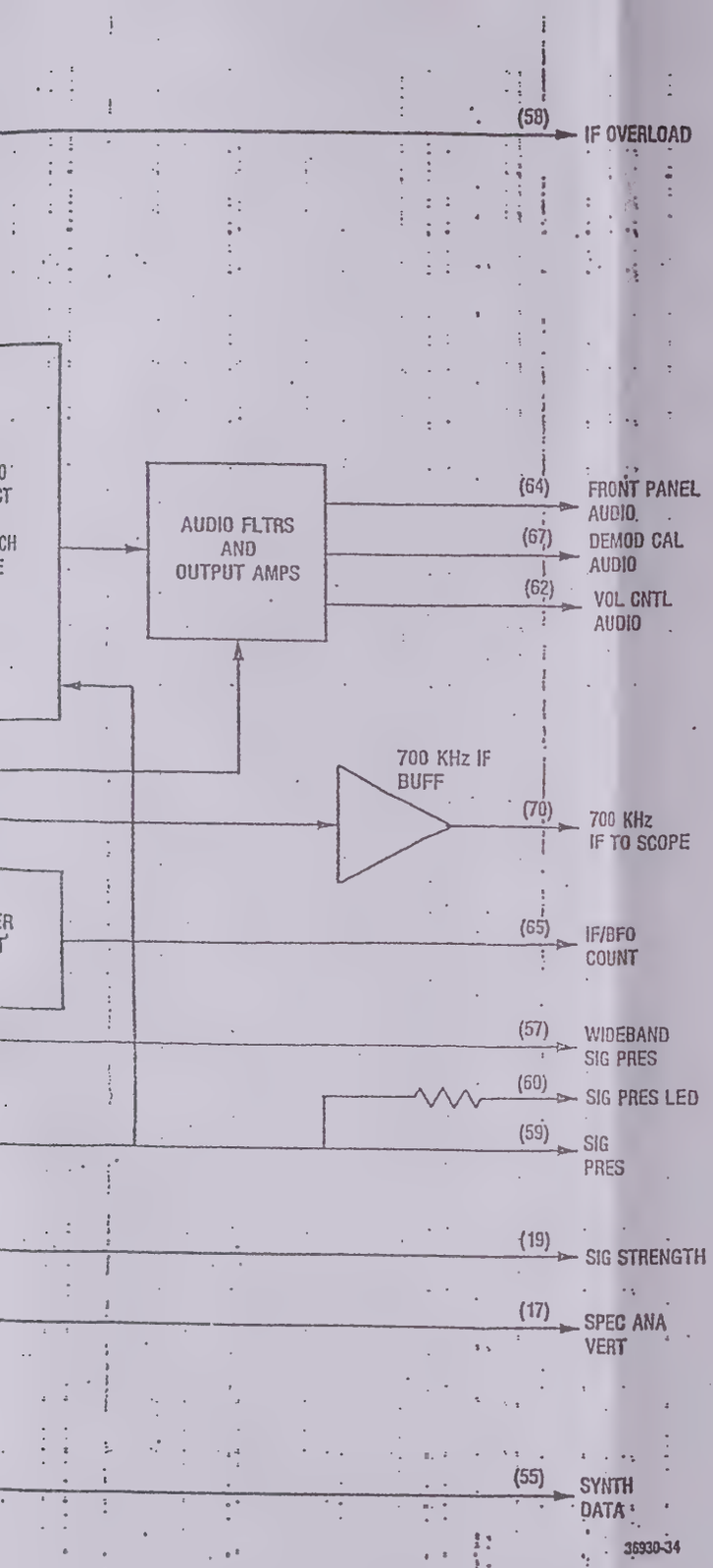
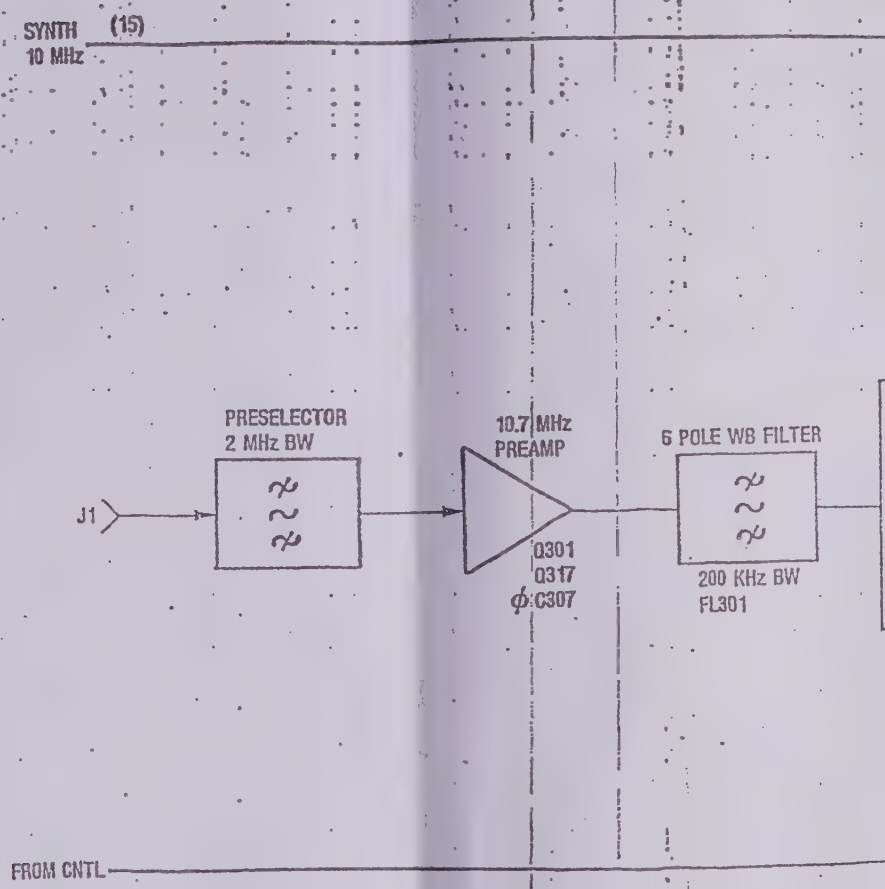
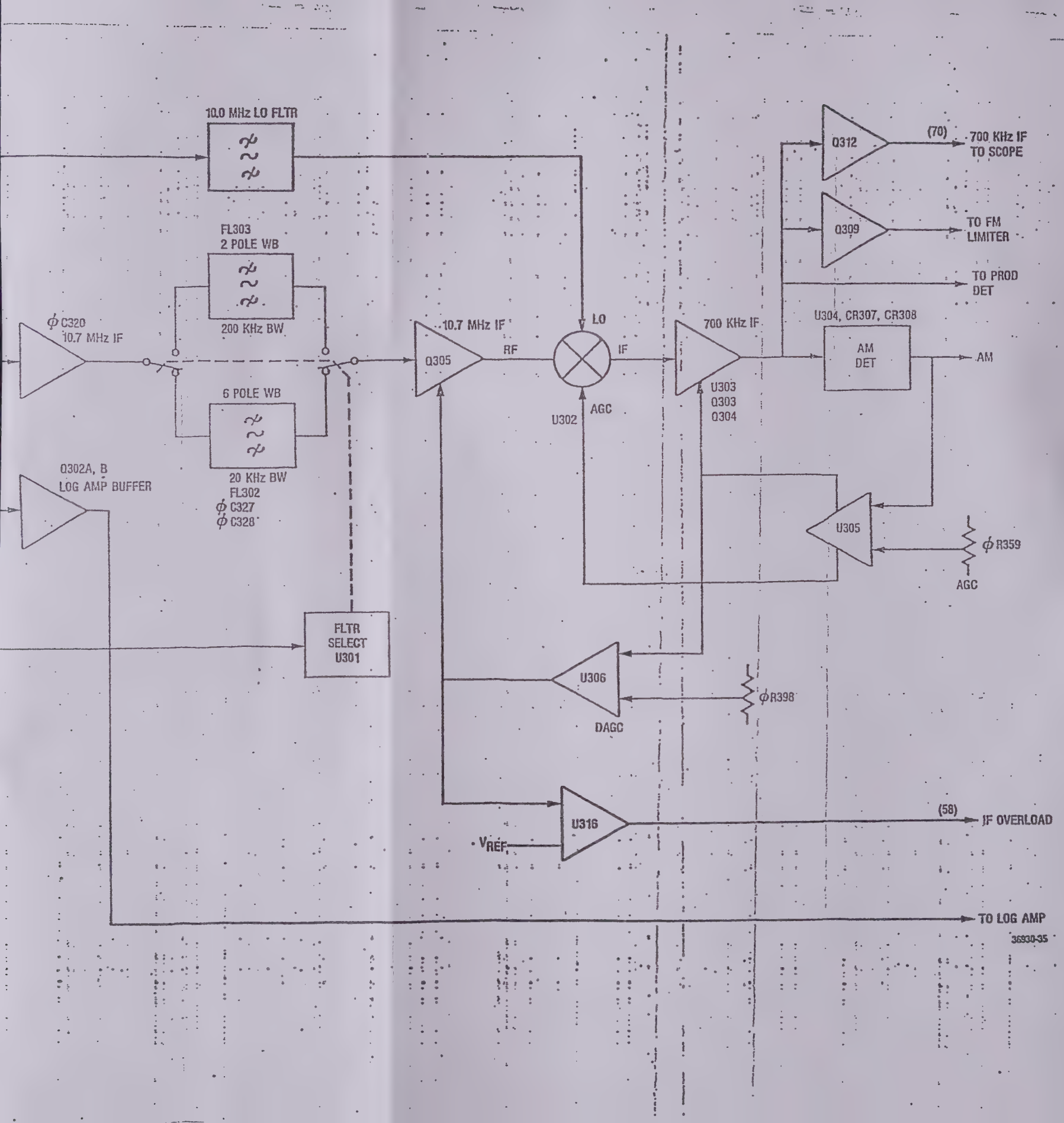


Figure 10-1b. Block Diagram (Sheet 2 of 4)



10-8


10.0 MHz LO FLTR
FL303
2 POLE WB
200 KHz BW
6 POLE WB
20 KHz BW
FL302
ϕ C327
ϕ C328
ϕ C320
10.7 MHz IF
Q302A, B
LOG AMP BUFFER
FLTR
SELECT
U301
Q305
10.7 MHz IF
RF
LO
IF
U302
AGC
700 KHz IF
U303
Q303
Q304
Q312
(70)
700 KHz IF
TO SCOPE
Q309
TO FM
LIMITER
TO PROD
DET
U304, CR307, CR308
AM
DET
AM
U305
ϕ R359
AGC
U306
ϕ R398
DAGC
U316
VREF
(58)
IF OVERLOAD
TO LOG AMP
36930-35

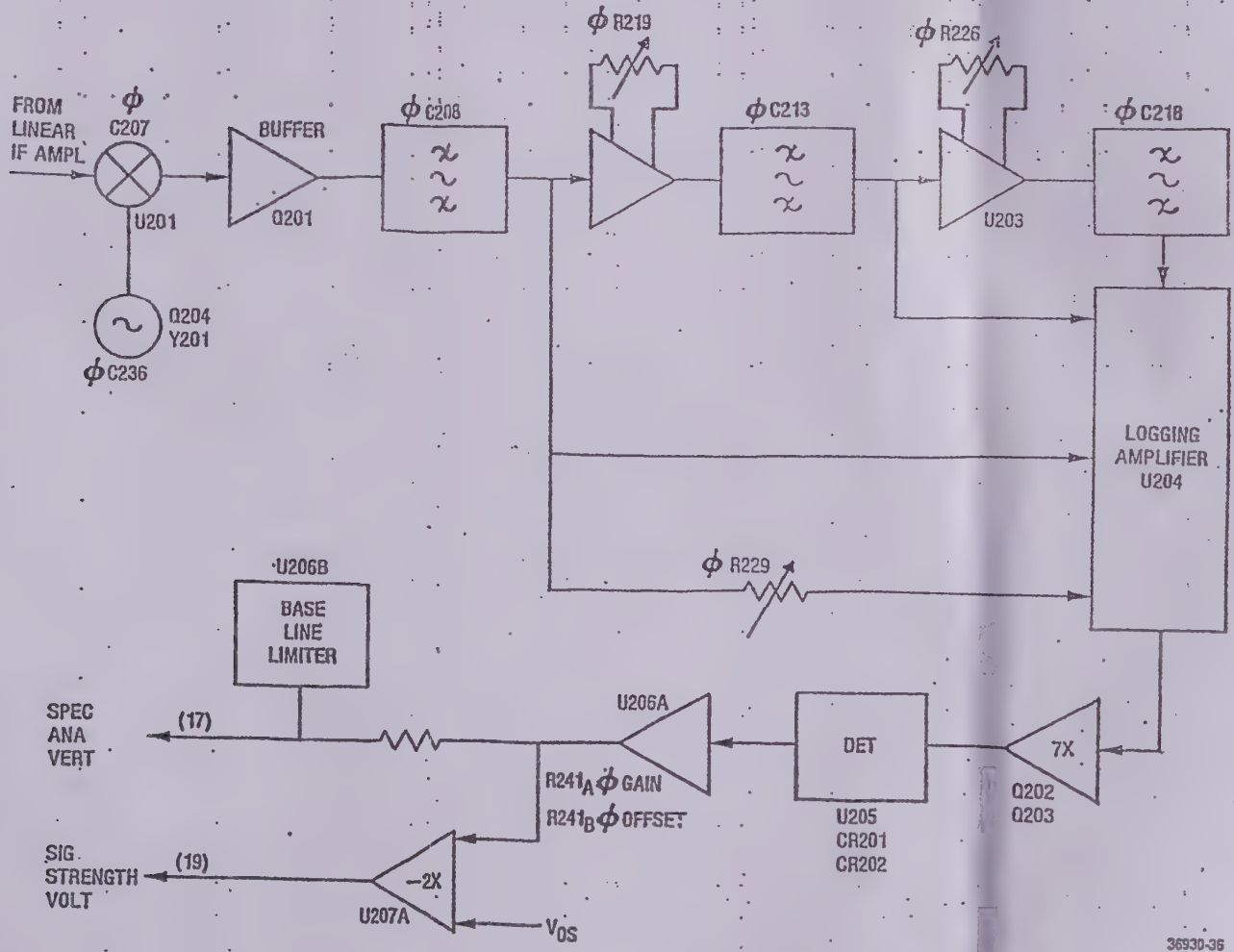


Figure 10-1c. Logarithmic Amplifier — Block Diagram

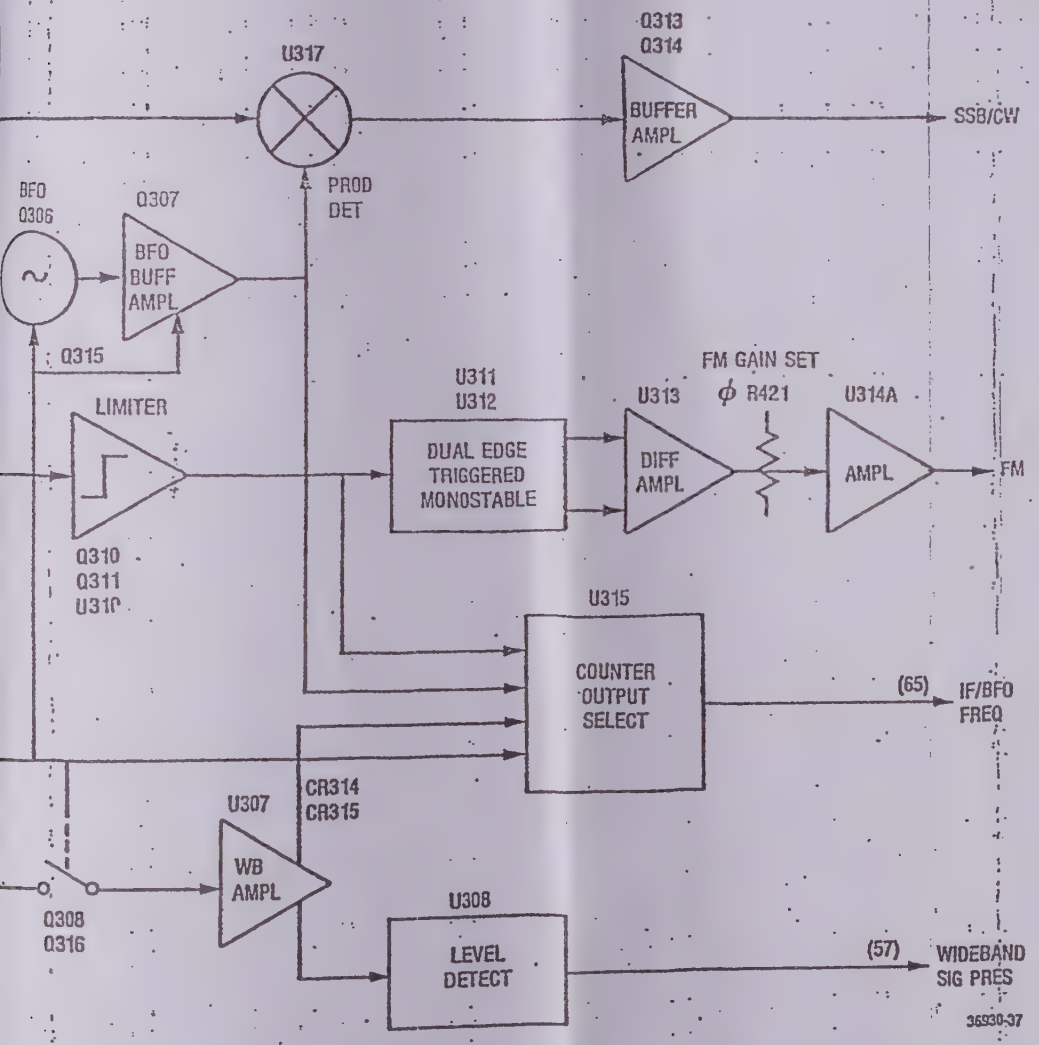


Figure 10-1d. FM/SSB/WB Signal-Present Detectors — Block Diagram

RECEIVER BOARD

LOGARITHMIC AMPLIFIER

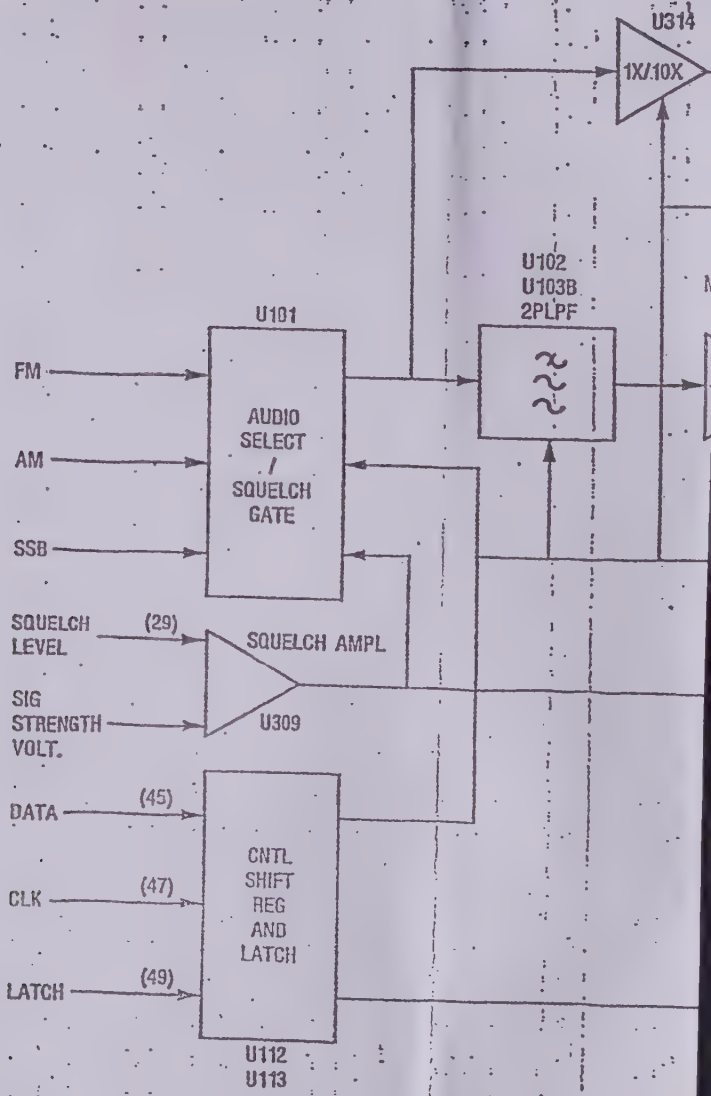
Figure 10-1c. Block Diagram

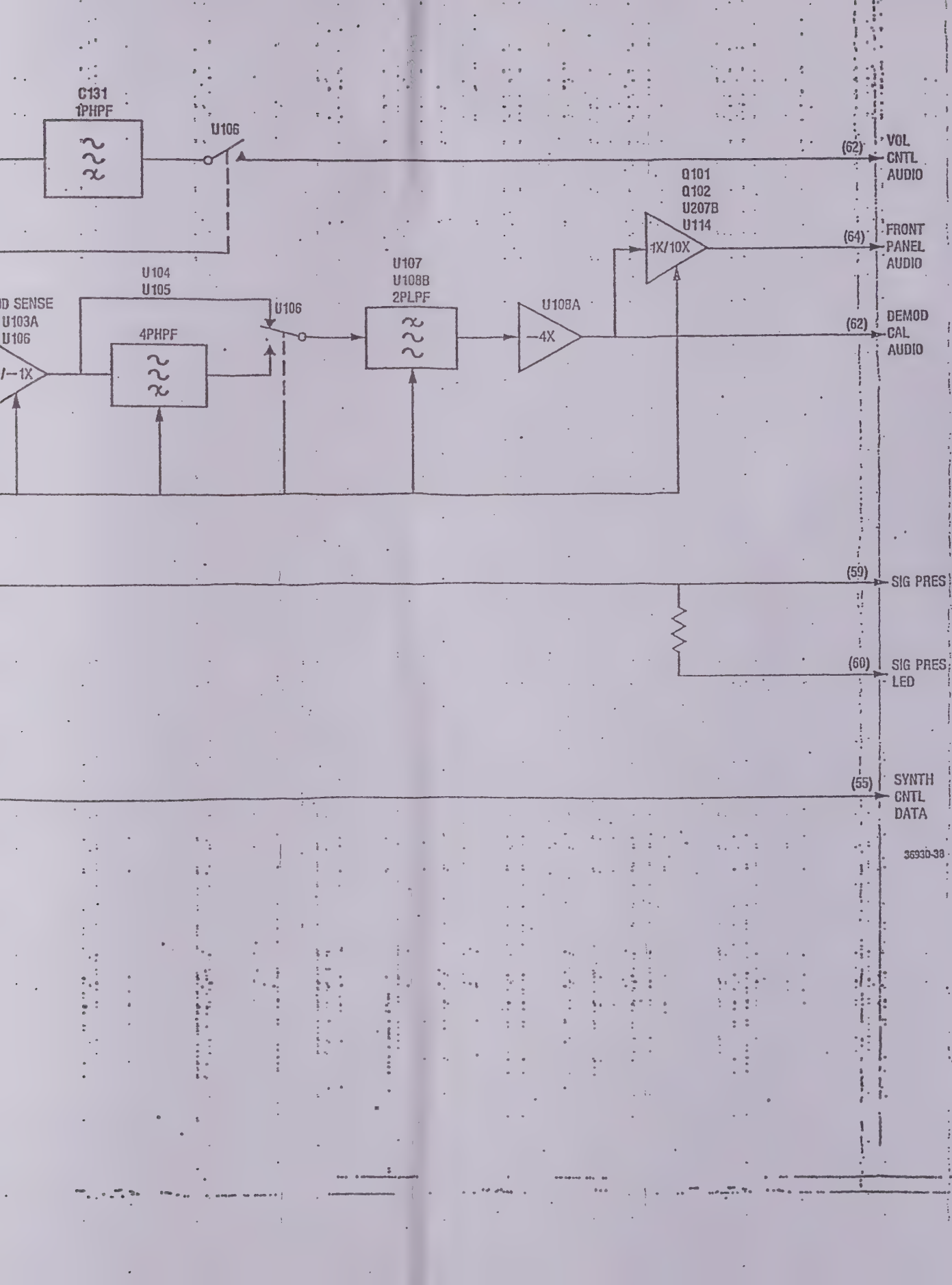
FM/SSB/WB SIGNAL-PRESENT DETECTORS

Figure 10-1d. Block Diagram (Sheet 3 of 4)

10-9

Figure 10-1e. Block Diagram (Sheet 4 of 4)




C131
1PHPF
U106
(62)
VOL
CNTL
AUDIO
Q101
Q102
U207B
U114
1X/10X
(64)
FRONT
PANEL
AUDIO
U104
U105
U106
U107
U108B
2PLPF
U108A
4PHPF
−4X
(62)
DEMOD
CAL
AUDIO
(59)
SIG PRES
(60)
SIG PRES
LED
(55)
SYNTH
CNTL
DATA
36930-38

1. UNLESS OTHERWISE SPECIFIED,
   ALL RESISTORS ARE IN OHMS ±5 PCT, 1/4 WATT.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.
2. FOR REFERENCE DRAWINGS REFER TO:
   01-P22081E PWB ASSEMBLY DRAWING
3. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN.
   FOR COMPLETE DESIGNATIONS PREFIX WITH A8.

⚠4 R204 IS A SELECT IN TEST. NOMINAL VALUE IS 680Ω: SELECT VALUES RANGE FROM 390Ω TO 1.2k Ω AS REQUIRED TO OBTAIN 5V. AT THE COLLECTOR OF Q201 WITH A-40 dBm CW INPUT TO THE RECEIVER (AT 10.7 MHz).

⚠5 C434 IS A SELECT IN TEST. NOMINAL VALUE IS NONE (OMIT PART). OTHER VALUE SHALL BE 270 PF, AS REQUIRED.

⚠6 R435 IS A SELECT IN TEST. NOMINAL VALUE IS SHOWN OTHER VALUE IS 39K Ω.
SEE SHEET 4.

7. ALL WAVEFORMS ARE WITH −60 dBm INTO J1 40% AM EXCEPT FM PATH WHICH IS 40 KHz DEV AND 550 WHICH IS CW THE LOG AMP WAVEFORMS ARE −40 dBm CW WIDEBAND RF AND AUDIO MODE

LOG AMP POST AMP

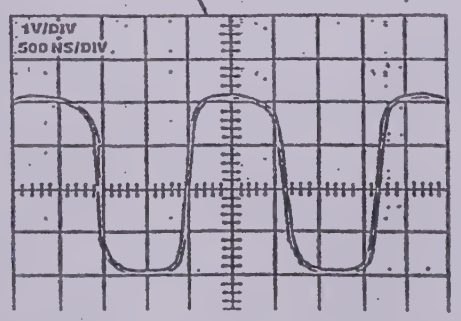
LOG AMP PEAK DETECTOR

LOG AMP OVERALL GAIN & OFFSET ADJUST

OFFSET BUFFER AM

SPECTRUM ANALYZER BASELINE CLIPPER

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY



RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-2a. Schematic (Sheet 1 of 5)

LAST USED	NOT USED
U317 FL304 R451 T103 C434 CR320 Q317 L325 VR302 Y201	U109, U116-U200 U208-U300 U110 CR317, CR318

17 SPECTRUM ANALIZER VOLT

19 SIG STRENGTH VOLTAGE

(B) TO SHEET 3

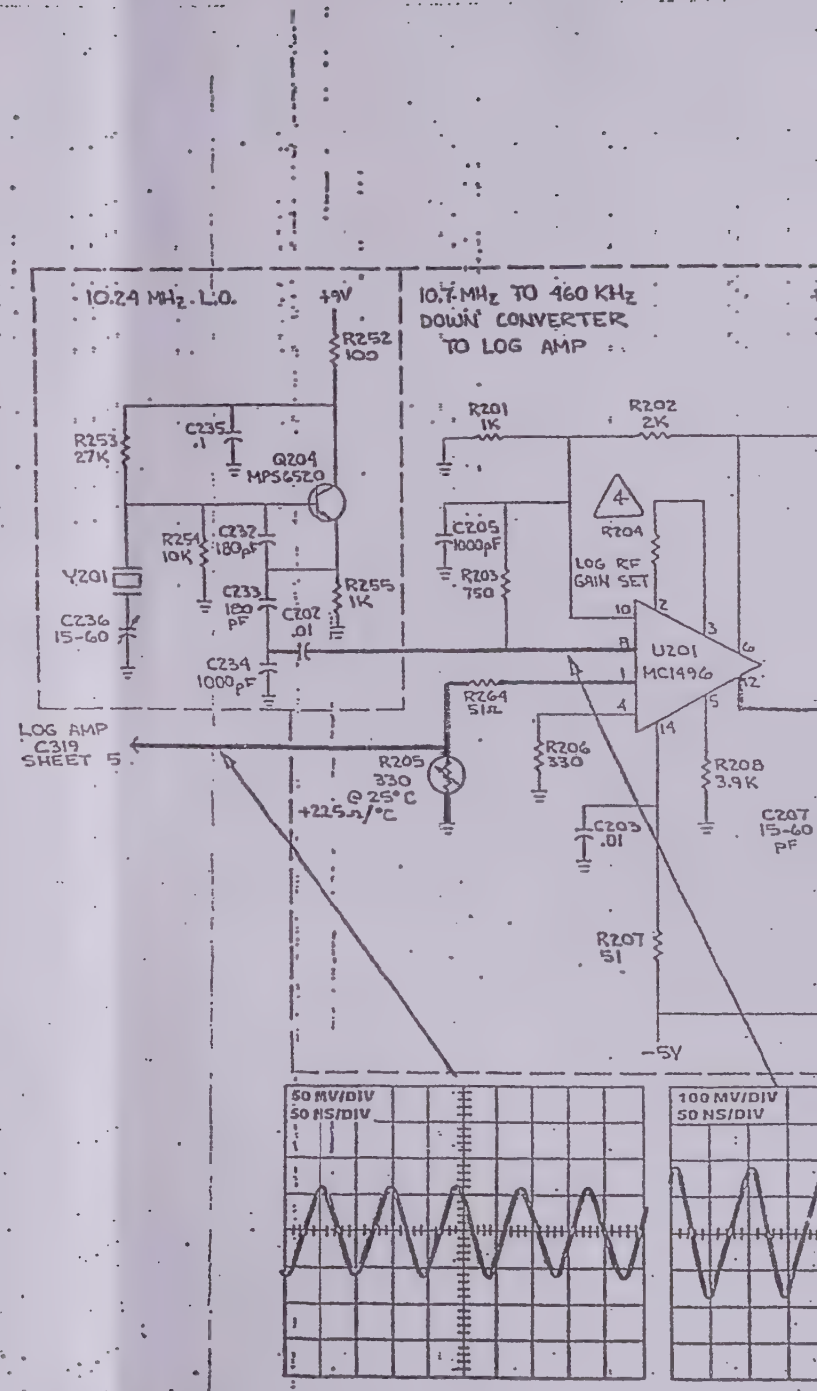
DEVICE		+5	GND	NO CONNECT	+12V	-12V	-5V	+5VREF
U101	HI-201		5	12	13	4		
U102	HI-201		5	12	13	4		
U103	LF412ACN				8	4		
U104	HI-201		3,5,14	12	13	4		
U105	CA3240E				8	4		
U106	HI-201		5	12	13	4		
U107	HI-201		5	12	13	4		
U108	LF412ACN				8	4		
U111	LM324		12		4	11		
U112	MC14094	15,16	8	9				
U113	MC14094	15,16	8	7,9,11,14				
U114	HI-201		5,16		13	4		
U115	MC1403		3					
U201	MC1496							
U202	MC1733P							
U203	MC1733P							
U204	TL441C	8	13					
U205	CA3240E	8					4	
U206	CA3240E	8	5				4	
U207	CA3240E		3		8	4		
U301	MC3488A		4		8	5		
U302	MC1496							
U303	CA3053							
U304	CA3240E				8	4		
U305	CA3240E				8	4		
U306	CA3240E				8	4		
U307	MC1733P							
U308	LM311	8	4				4	
U309	LM311		4		8			
U310	74HC04	13,14	7					
U311	74LS221		8					3,10,11,16
U312	74HC02		7					14
U313	LF356				7	4		
U314	CA3240E				8	4		
U315	HI-201		5		13	4		
U316	LM311		4		8	4		
U317	CA3053		7			4		

36930-40 A

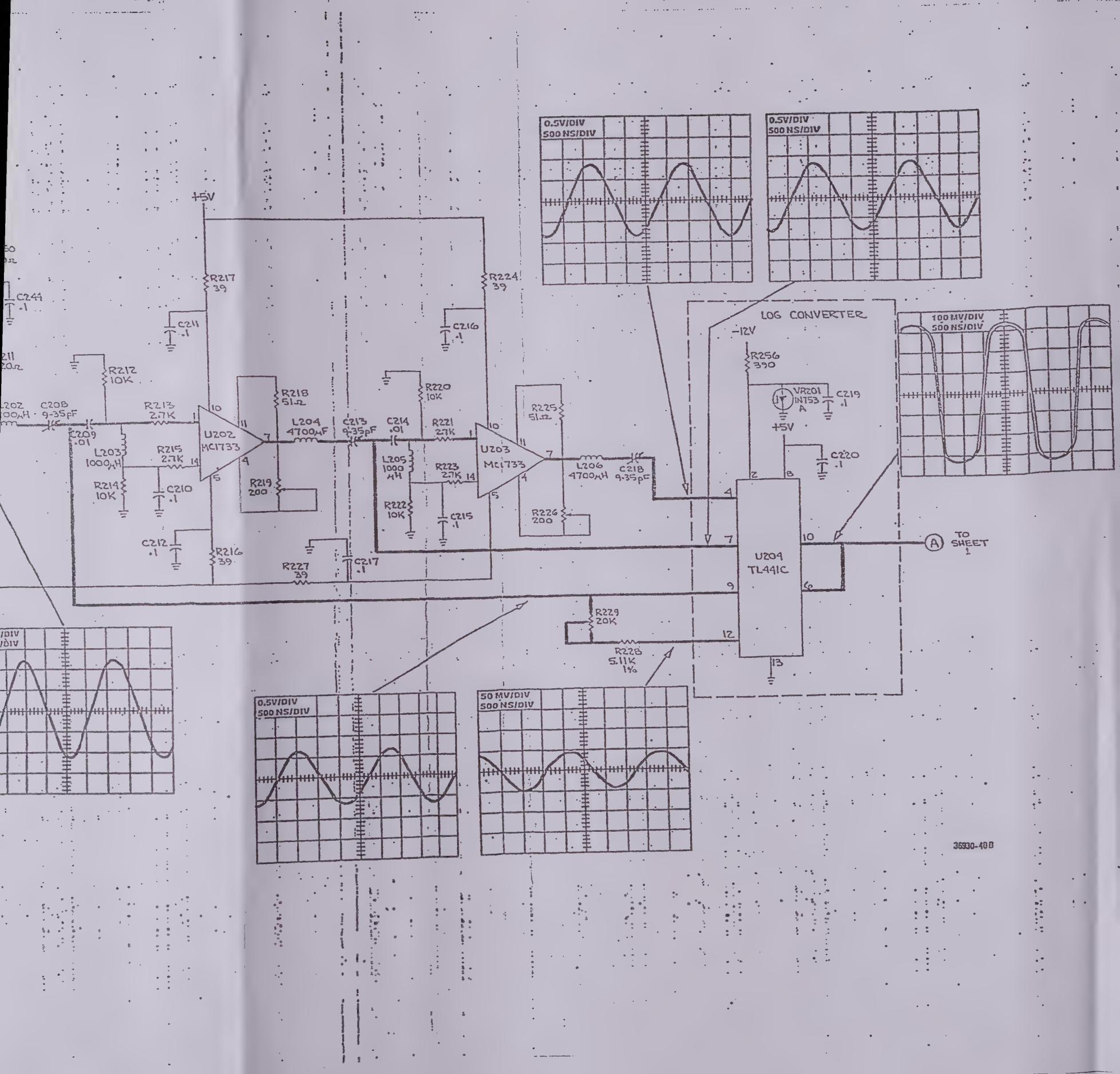
RECEIVER BOARD (A8)

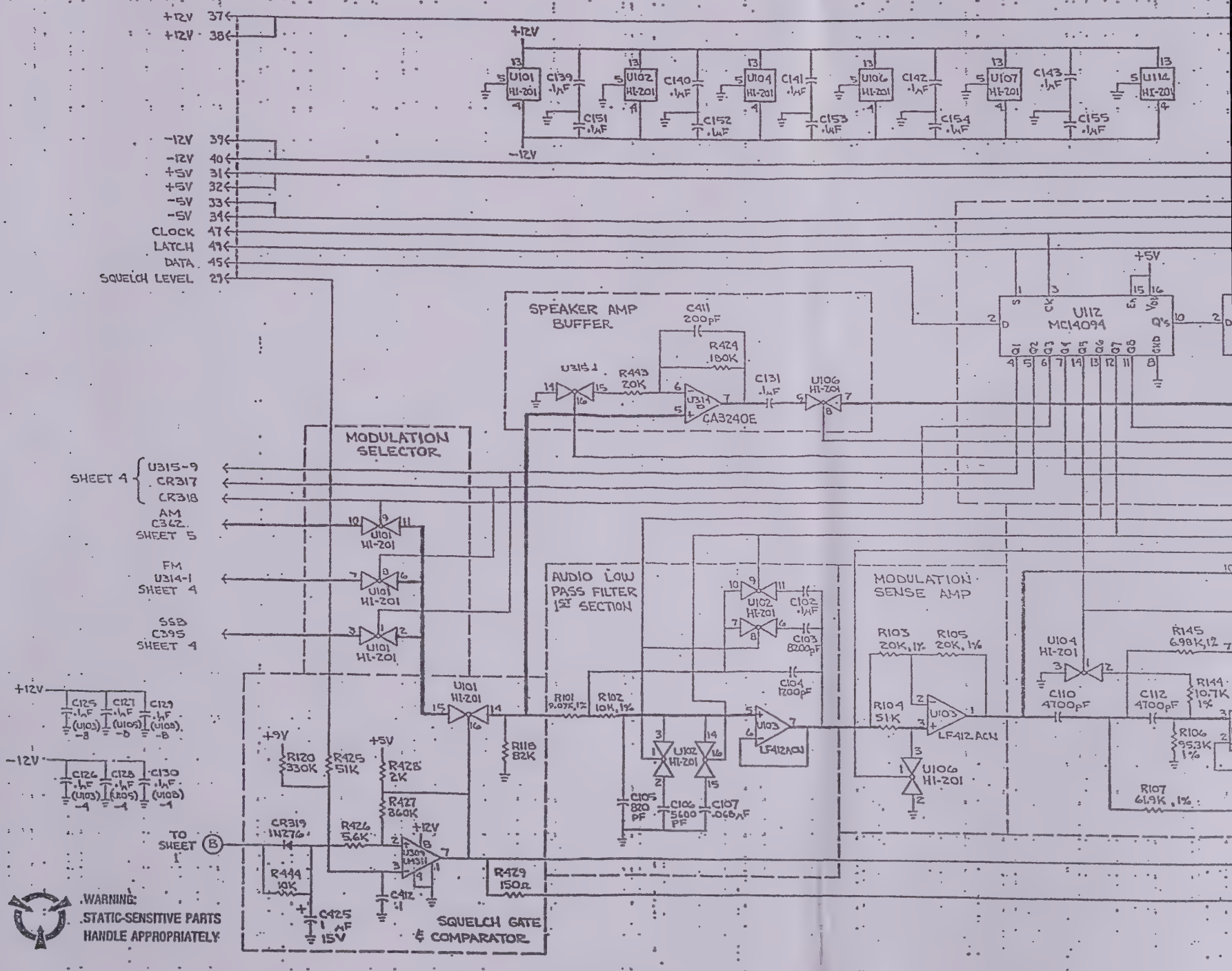
(RTL-1019A)

Figure 10-2b. Schematic (Sheet 2 of 5)



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY


+5V
R217 39
R224 39
C211 .1
C216 .1
R212 10K
R218 51Ω
R220 10K
R225 51Ω
C208 9-35pF
R213 2.7K
L204 4700μH
C213 9-35pF
C214 .01
R221 2.7K
C209 .01
L203 1000μH
R215 2.7K
U202 MC1733
U203 MC1733
L205 1000 μH
R223 2.7K
L206 4700μH
C218 9-35pF
R214 10K
C210 .1
R219 200
R222 10K
C215 .1
R226 200
C212 .1
R216 39
R227 39
C217 .1
LOG CONVERTER
-12V
R256 390
VR201 IN753 A
C219 .1
+5V
C220 .1
U204 TL441C
TO SHEET 1
R229 20K
R228 5.11K 1%
0.5V/DIV 500 NS/DIV
0.5V/DIV 500 NS/DIV
100 MV/DIV 500 NS/DIV
0.5V/DIV 500 NS/DIV
50 MV/DIV 500 NS/DIV
36930-400


+12V 37
+12V 38
-12V 39
-12V 40
+5V 31
+5V 32
-5V 33
-5V 34
CLOCK 47
LATCH 46
DATA 45
SQUELCH LEVEL 29
SPEAKER AMP BUFFER
C411 200pF
R424 180K
R443 20K
C131 .1µF
U106 HI-201
CA3240E
U112 MC14094
MODULATION SELECTOR
SHEET 4 U315-9 CR317 CR318
AM C362 SHEET 5
FM U314-1 SHEET 4
SSB C395 SHEET 4
U101 HI-201
AUDIO LOW PASS FILTER 1ST SECTION
R101 9.07K,1%
R102 10K,1%
C102 .1µF
C103 8200pF
C104 1200pF
C105 820 PF
C106 5600 PF
C107 .068µF
U102 HI-201
U103 LF412ACN
MODULATION SENSE AMP
R103 20K,1%
R105 20K,1%
R104 51K
U104 HI-201
C110 4700pF
C112 4700pF
R145 6.98K,1%
R144 10.7K 1%
R106 95.3K 1%
R107 61.9K,1%
U106 HI-201
+12V
-12V
+9V
+5V
C125 .1µF (U103) -8
C127 .1µF (U105) -8
C129 .1µF (U108) -8
C126 .1µF (U103) -4
C128 .1µF (U105) -4
C130 .1µF (U108) -4
R120 330K
R425 51K
R428 2K
R427 360K
R426 5.6K
R118 82K
CR319 1N276
R444 10K
C425 1 µF 15V
C412 .1
U309 LM311
R429 150Ω
TO SHEET 1 (B)
SQUELCH GATE & COMPARATOR
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-2c. Schematic (Sheet 3 of 5)

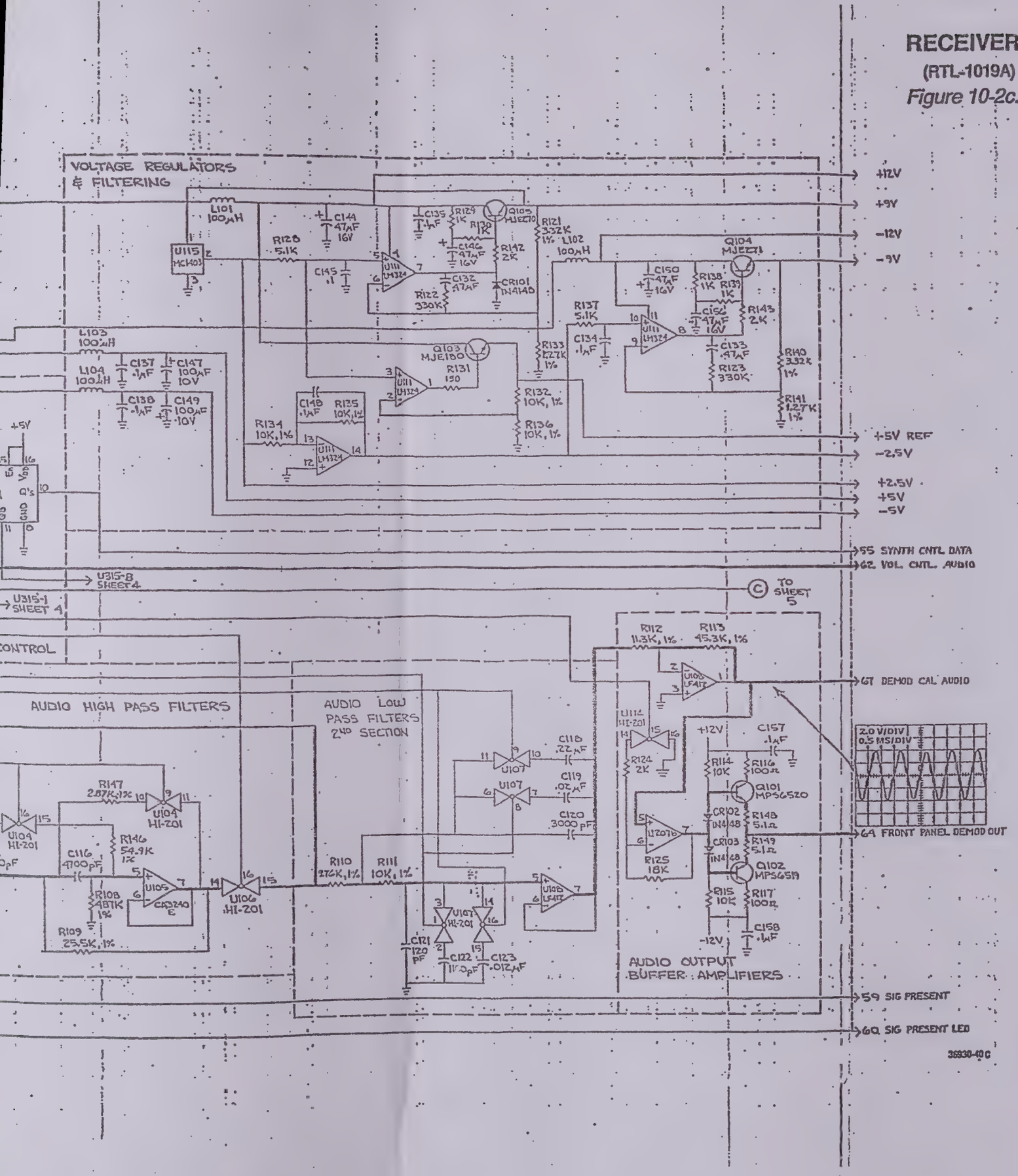
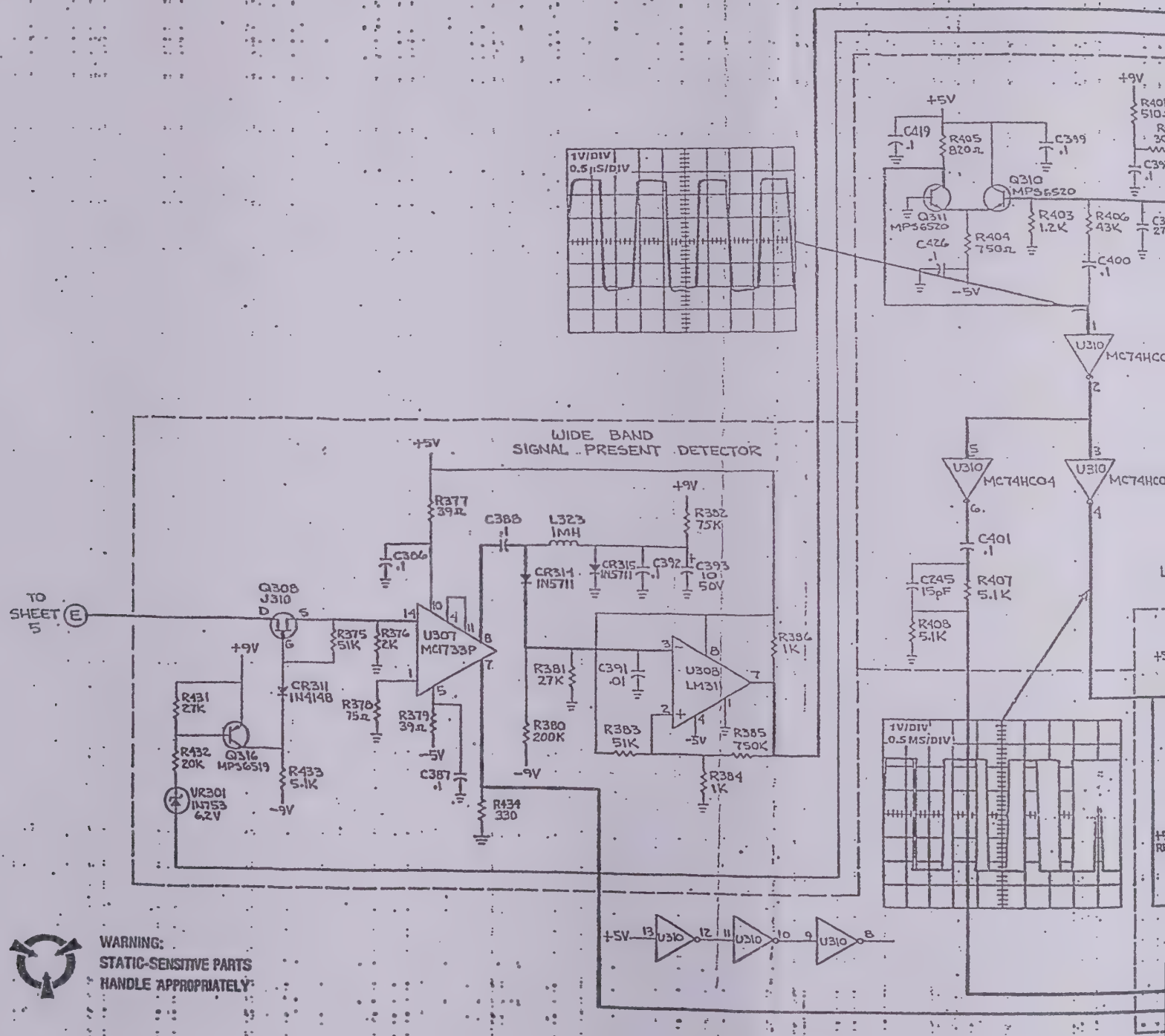
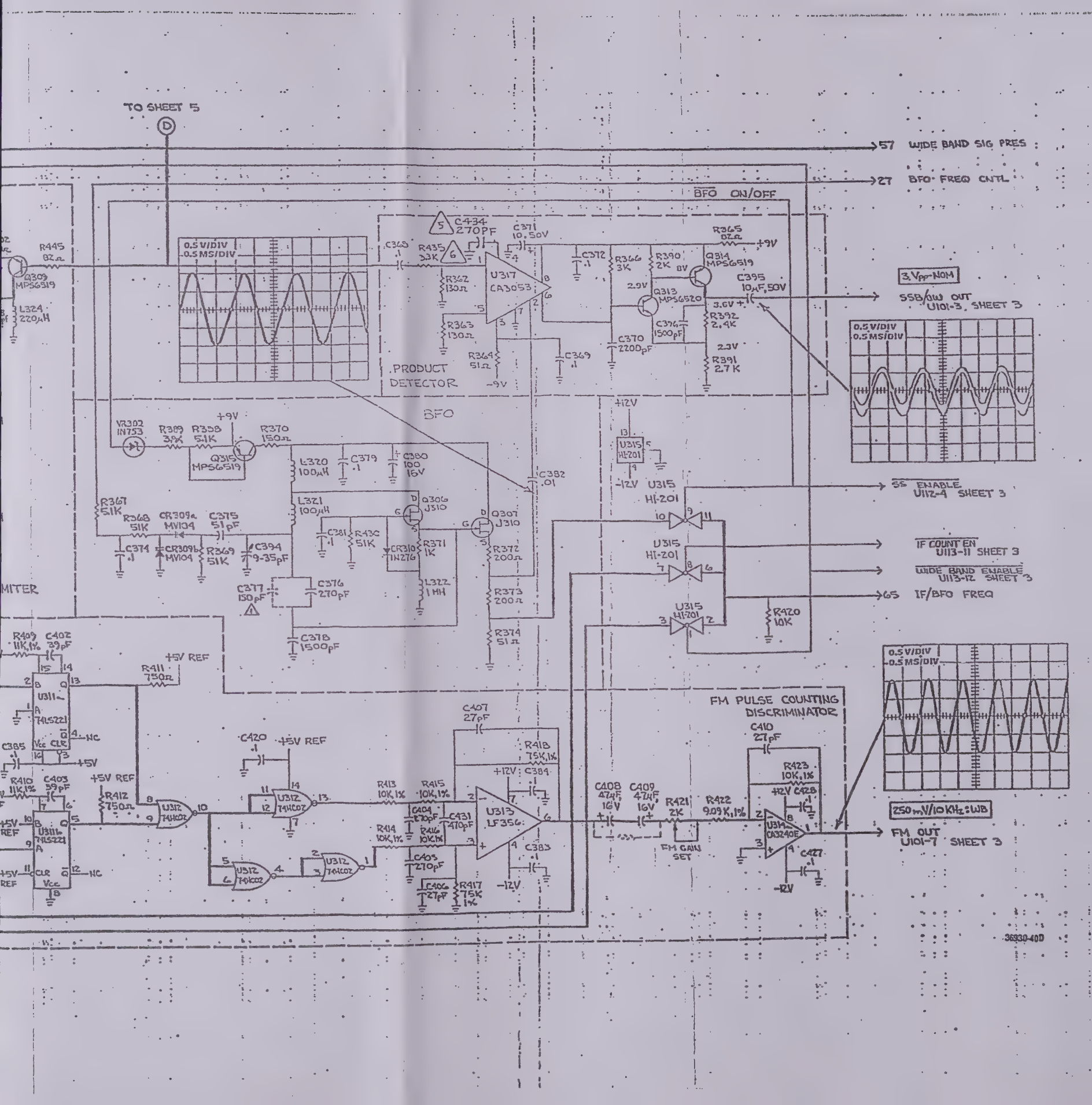
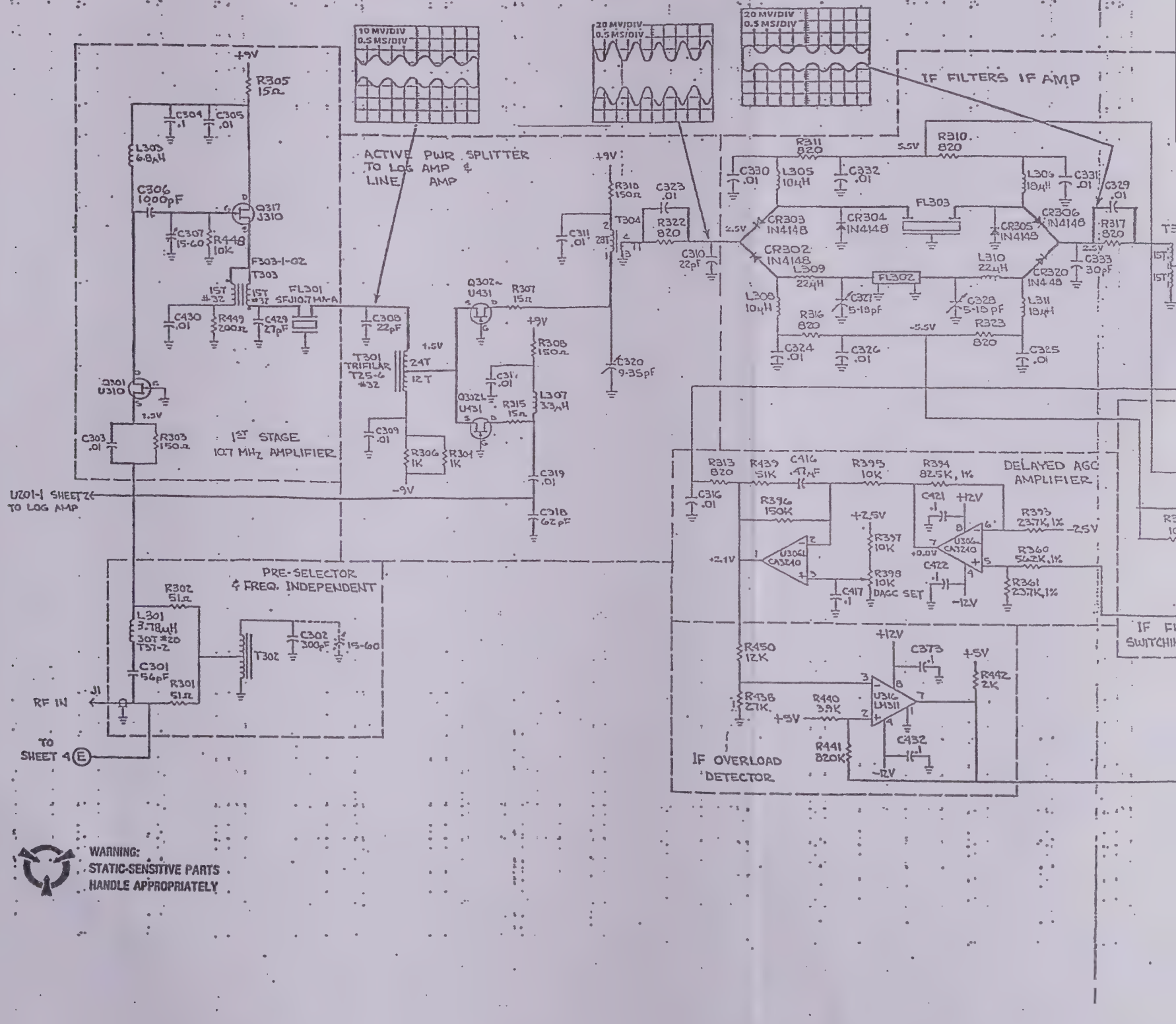


Figure 10-2d. Schematic (Sheet 4 of 5)



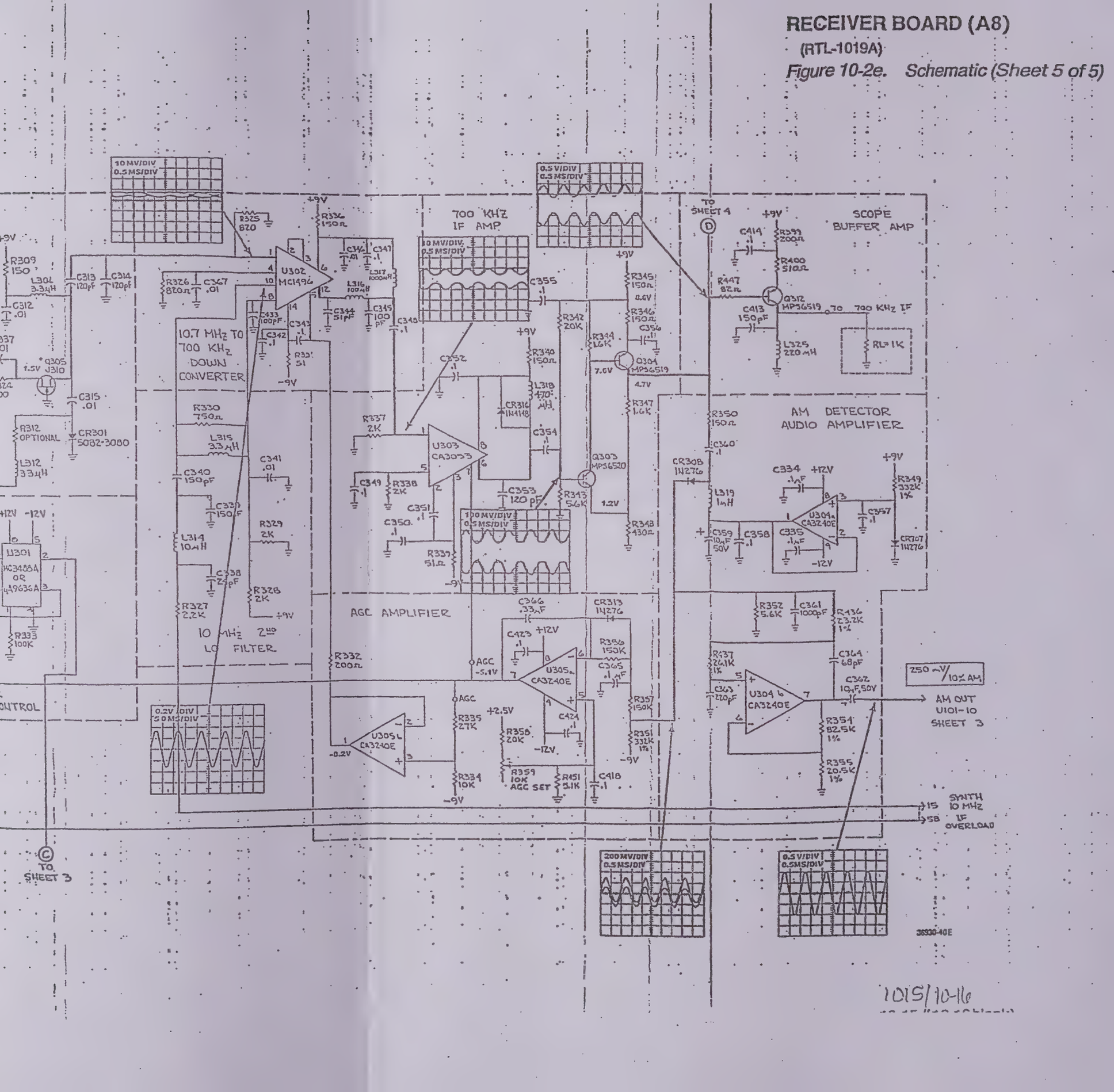

TO SHEET 5
57 WIDE BAND SIG PRES
27 BFO FREQ CNTL
BFO ON/OFF
C434 270PF
C371 10, 50V
R365 0Ω
+9V
R435 33K
C360 .1
U317 CA3053
R342 130Ω
R363 130Ω
R364 51Ω
-9V
C369 .1
C372 .1
R366 3K
R390 2K
8V
Q314 MPS6519
2.9V
Q313 MPS6520
C376 1500pF
C370 2200pF
C395 10μF, 50V
3.6V
R392 2.4K
2.3V
R391 2.7K
3.Vpp-NOM
SSB/CW OUT U101-3, SHEET 3
0.5V/DIV
0.5MS/DIV
PRODUCT DETECTOR
BFO
+12V
U315 HI-201
-12V
SS ENABLE U112-4 SHEET 3
IF COUNT EN U113-11 SHEET 3
WIDE BAND ENABLE U113-12 SHEET 3
65 IF/BFO FREQ
R420 10K
VR302 IN753
R309 3.9K
R358 5.1K
R370 150Ω
Q315 MPS6519
L320 100μH
C379 .1
C380 100 16V
C382 .01
R367 5.1K
R368 5.1K
CR309a MV104
C375 51pF
C374 .1
CR309b MV104
R369 5.1K
C394 9-35pF
L321 100μH
Q306 J310
Q307 J310
C381 .1
R430 5.1K
CR310 TIN276
R371 1K
L322 1 MH
R372 200Ω
R373 200Ω
R374 51Ω
C377 150pF
C376 270pF
C378 1500pF
MITER
R409 11K,1%
C402 39pF
+5V REF
R411 750Ω
U311 74LS221
C385 .1
+5V
NC
R410 11K,1%
C403 39pF
R412 750Ω
U312 74HC02
C420 .1
R413 10K,1%
R415 10K,1%
R414 10K,1%
R416 10K,1%
C404 270pF
C431 470pF
C405 270pF
C406 27pF
R417 75K 1%
U313 LF356
C407 27pF
R418 75K,1%
C384 .1
C383 .1
FM PULSE COUNTING DISCRIMINATOR
C408 47μF 16V
C409 47μF 16V
R421 2K
FM GAIN SET
R422 9.09K,1%
C410 27pF
R423 10K,1%
C428 .1
U314 OA3240E
C427 .1
250mV/10KHz:WB
FM OUT U101-7 SHEET 3
36930-40D


10 MV/DIV
0.5 MS/DIV
20 MV/DIV
0.5 MS/DIV
20 MV/DIV
0.5 MS/DIV
IF FILTERS IF AMP
ACTIVE PWR SPLITTER TO LOG AMP & LINE AMP
1ST STAGE 10.7 MHz AMPLIFIER
PRE-SELECTOR & FREQ. INDEPENDENT
DELAYED AGC AMPLIFIER
IF OVERLOAD DETECTOR
U201-1 SHEET 2 TO LOG AMP
RF IN
TO SHEET 4 E
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

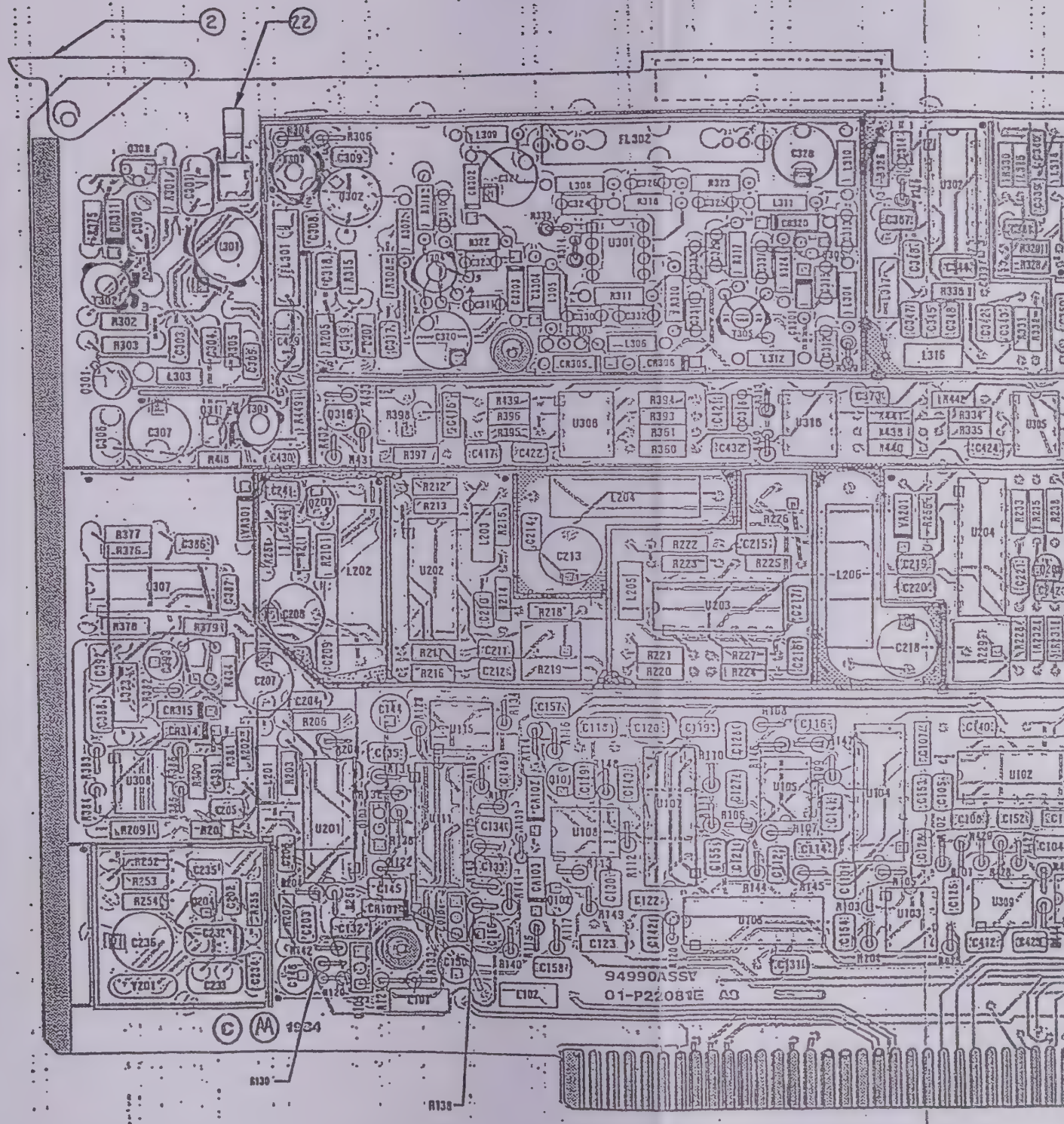
RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-2e. Schematic (Sheet 5 of 5)



1015/10-16



FRONT AND BACK OF FOUR LAYER RECEIVER BOARD.

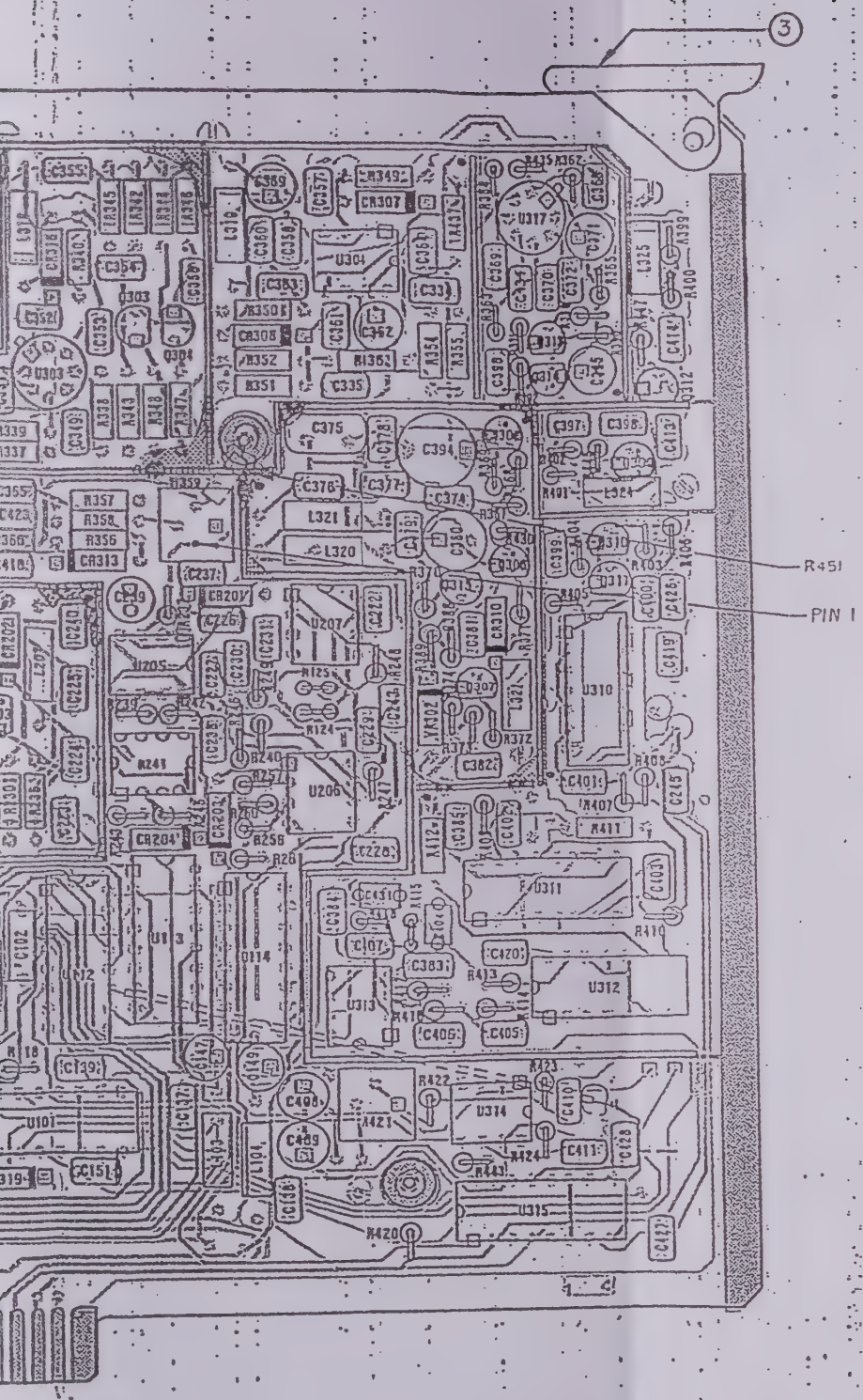
COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.

(See Sheet 2, p. 10-19, for Parts List)

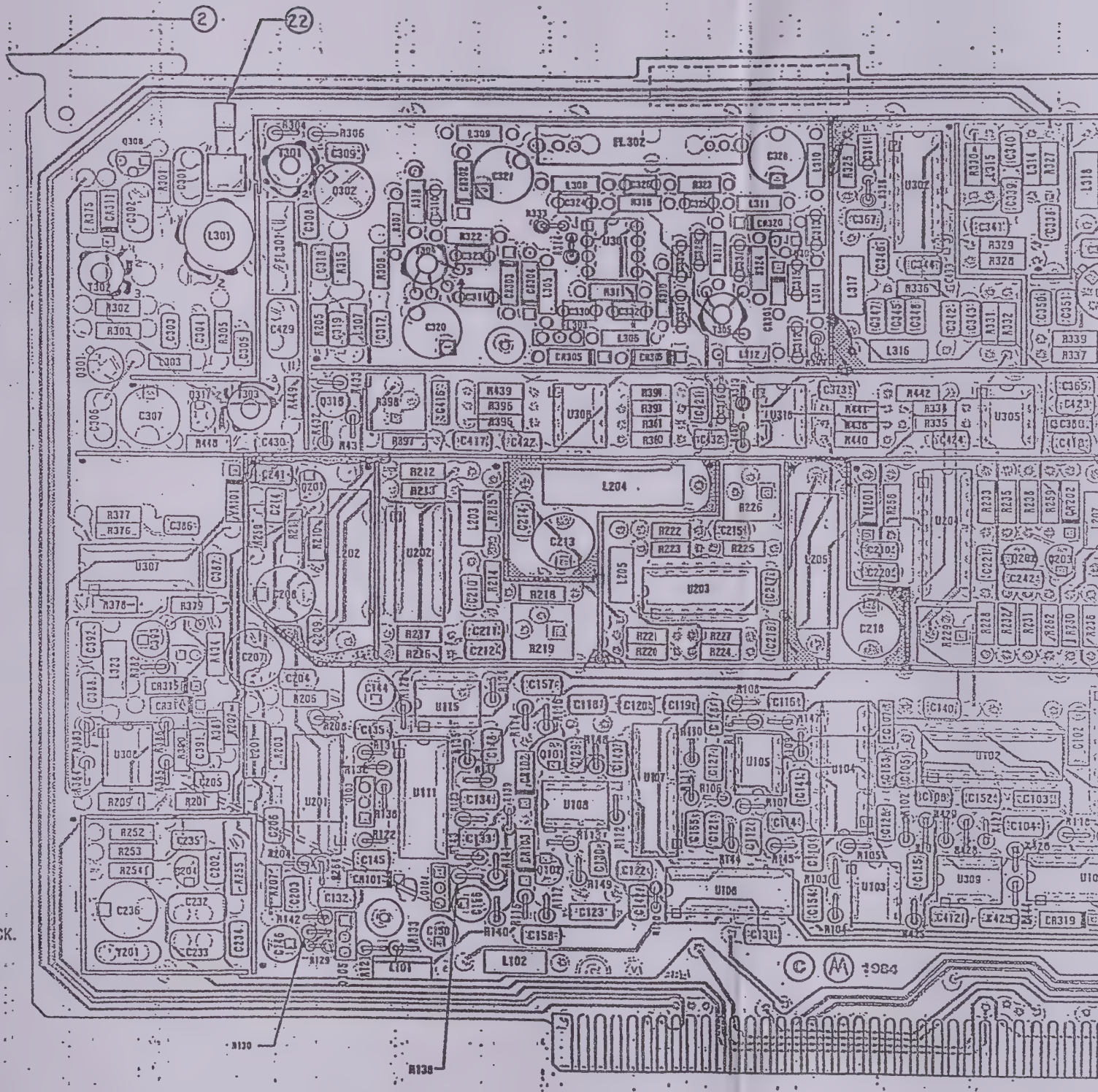
RECEIVER BOARD (A8)

(RTL-1019A)

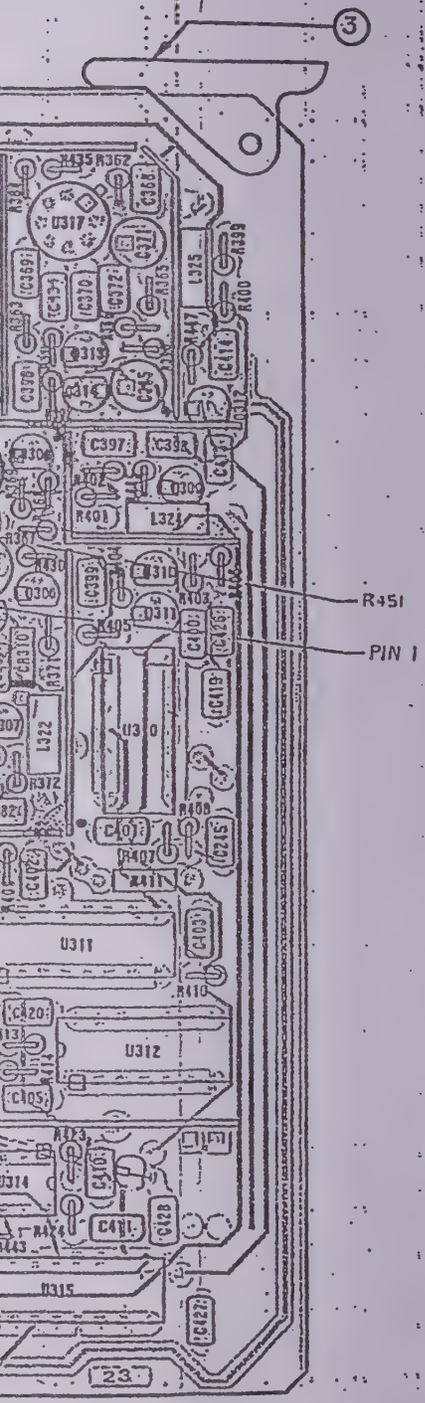
Figure 10-3a. Printed Wiring Board Assembly and Parts List (Sheet 1 of 4)



10-17/1818



INNER TWO LAYERS OF FOUR LAYER RECEIVER BOARD.
COMPONENTS SHOWN IN BLACK.
LAYER 2 SHOWN IN GREY.
LAYER 3 SHOWN IN ORANGE.



RECEIVER BOARD (A8)
RTL-1019A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
002	1	45-80339B28	CARD EJECTOR	
003	1	45-80339B41	CARD EJECTOR	MARKED
022	1	09-80344B23	CONNECTOR	
032	1	15-80370A99	COVER, RECEIVER ASSEMBLY	
033	4	03-124432	SCREW	4-40X.250
C102	1	08-80343B12	CAPACITOR	.1UF-10-100
C103	1	21-80342B41	CAPACITOR	8200PF-5-50
C104	1	21-80341B49	CAPACITOR	1200PF-5-50
C105	1	21-80341B90	CAPACITOR	820PF-5-50
C106	1	21-80341B86	CAPACITOR	5600PF-5-50
C107	1	08-80343B19	CAPACITOR	.068UF-5-63
C110	1	21-80341B83	CAPACITOR	4700PF-5-50
C112	1	21-80341B83	CAPACITOR	4700PF-5-50
C114	1	21-80341B83	CAPACITOR	4700PF-5-50
C116	1	21-80341B83	CAPACITOR	4700PF-5-50
C118	1	21-80372B66	CAPACITOR	.22UF-5-63
C119	1	21-80342B38	CAPACITOR	.02UF-5-50
C120	1	21-80341B67	CAPACITOR	3000PF-5-20
C121	1	21-80341B48	CAPACITOR	120PF-5-50
C122	1	21-80341B47	CAPACITOR	1100FF-5-50
C123	1	21-80342B35	CAPACITOR	.012UF-10-50
C125	1	21-80342B10	CAPACITOR	.1UF-20-50
C126	1	21-80342B10	CAPACITOR	.1UF-20-50
C127	1	21-80342B10	CAPACITOR	.1UF-20-50
C128	1	21-80342B10	CAPACITOR	.1UF-20-50
C129	1	21-80342B10	CAPACITOR	.1UF-20-50
C130	1	21-80342B10	CAPACITOR	.1UF-20-50
C131	1	21-80342B10	CAPACITOR	.1UF-20-50
C132	1	21-80342B14	CAPACITOR	.47UF-20-50
C133	1	21-80342B14	CAPACITOR	.47UF-20-50
C134	1	21-80342B10	CAPACITOR	.1UF-20-50
C135	1	21-80342B10	CAPACITOR	.1UF-20-50
C137	1	21-80342B10	CAPACITOR	.1UF-20-50
C138	1	21-80342B10	CAPACITOR	.1UF-20-50
C139	1	21-80342B10	CAPACITOR	.1UF-20-50
C140	1	21-80342B10	CAPACITOR	.1UF-20-50
C141	1	21-80342B10	CAPACITOR	.1UF-20-50
C142	1	21-80342B10	CAPACITOR	.1UF-20-50
C143	1	21-80342B10	CAPACITOR	.1UF-20-50
C144	1	23-80341B11	CAPACITOR	47UF-20-16
C145	1	21-80342B10	CAPACITOR	.1UF-20-50
C146	1	23-80341B11	CAPACITOR	47UF-20-16
C147	1	23-80341B07	CAPACITOR	100UF-20-10
C148	1	21-80342B10	CAPACITOR	.1UF-20-50
C149	1	23-80341B07	CAPACITOR	100UF-20-10
C150	1	23-80341B11	CAPACITOR	47UF-20-16
C151	1	21-80342B10	CAPACITOR	.1UF-20-50
C152	1	21-80342B10	CAPACITOR	.1UF-20-50
C153	1	21-80342B10	CAPACITOR	.1UF-20-50
C154	1	21-80342B10	CAPACITOR	.1UF-20-50
C155	1	21-80342B10	CAPACITOR	.1UF-20-50
C156	1	23-80341B11	CAPACITOR	47UF-20-16
C157	1	21-80342B10	CAPACITOR	.1UF-20-50
C158	1	21-80342B10	CAPACITOR	.1UF-20-50
C202	1	21-80342B09	CAPACITOR	.01UF-20-50
C203	1	21-80342B09	CAPACITOR	.01UF-20-50
C204	1	21-80342B10	CAPACITOR	.1UF-20-50
C205	1	21-80341B93	CAPACITOR	1000PF-20-100
C206	1	21-80341B82	CAPACITOR	470PF-5-50
C207	1	20-80343B37	CAPACITOR, VARIABLE	15 TO 60PF-200
C208	1	20-80396A57	CAPACITOR	9 TO 35PF-200
C209	1	21-80342B09	CAPACITOR	.01UF-20-50
C210	1	21-80342B10	CAPACITOR	.1UF-20-50
C211	1	21-80342B10	CAPACITOR	.1UF-20-50
C212	1	21-80342B10	CAPACITOR	.1UF-20-50
C213	1	20-80396A57	CAPACITOR	9 TO 35PF-200
C214	1	21-80342B09	CAPACITOR	.01UF-20-50
C215	1	21-80342B10	CAPACITOR	.1UF-20-50
C216	1	21-80342B10	CAPACITOR	.1UF-20-50
C217	1	21-80342B10	CAPACITOR	.1UF-20-50
C218	1	20-80396A57	CAPACITOR, VARIABLE	9-35PF
C219	1	21-80342B10	CAPACITOR	.1UF-20-50
C220	1	21-80342B10	CAPACITOR	.1UF-20-50
C221	1	21-80342B10	CAPACITOR	.1UF-20-50
C222	1	21-80342B10	CAPACITOR	.1UF-20-50
C223	1	21-80342B10	CAPACITOR	.1UF-20-50
C224	1	21-80342B10	CAPACITOR	.1UF-20-50
C225	1	21-80342B01	CAPACITOR	.022UF-10-100
C226	1	21-80342B10	CAPACITOR	.1UF-20-50
C227	1	21-80341B69	CAPACITOR	330PF-5-50
C228	1	21-80342B10	CAPACITOR	.1UF-20-50

RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-3b. Printed Wiring Board Assembly and Parts List (Sheet 2 of 4)

RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-3b. Printed Wiring Board Assembly and Parts List (Sheet 3 of 4)

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C229	1	21-80342B10	CAPACITOR	.1UF-20-50
C230	1	21-80342B10	CAPACITOR	.1UF-20-50
C231	1	21-80342B10	CAPACITOR	.1UF-20-50
C232	1	21-80369A95	CAPACITOR	180PF-5-500
C233	1	21-80369A95	CAPACITOR	180PF-5-500
C234	1	21-80341B46	CAPACITOR	1000PF-5-50
C235	1	21-80342B10	CAPACITOR	.1UF-20-50
C236	1	20-80343B37	CAPACITOR	15 TO 60PF-200
C237	1	21-80342B10	CAPACITOR	.1UF-20-50
C238	1	21-80342B10	CAPACITOR	.1UF-20-50
C239	1	23-80341B15	CAPACITOR	10UF-20-50
C240	1	21-80342B10	CAPACITOR	.1UF-20-50
C241	1	21-80341B72	CAPACITOR	350PF-5-50
C242	1	21-80342B10	CAPACITOR	.1UF-20-50
C243	1	21-80344B38	CAPACITOR	.047UF-10-100
C244	1	21-80342B10	CAPACITOR	.1UF-20-50
C245	1	21-80341B53	CAPACITOR	15PF-5-50
C301	1	21-80339B17	CAPACITOR	55PF-5-500
C302	1	21-80339B23	CAPACITOR	300PF-5-300
C303	1	21-80341B94	CAPACITOR	.01UF-10-100
C304	1	21-80342B10	CAPACITOR	.1UF-20-50
C305	1	21-80341B94	CAPACITOR	.01UF-10-100
C306	1	21-80341B54	CAPACITOR	1000PF-5-50
C307	1	20-80343B37	CAPACITOR, VARIABLE	15 TO 60PF-200
C308	1	21-80341B62	CAPACITOR	22PF-5-50
C309	1	21-80341B94	CAPACITOR	.01UF-10-100
C310	1	21-80341B62	CAPACITOR	22PF-5-50
C311	1	21-80341B94	CAPACITOR	.01UF-10-100
C312	1	21-80341B94	CAPACITOR	.01UF-10-100
C313	1	21-80341B48	CAPACITOR	120PF-5-50
C314	1	21-80341B48	CAPACITOR	120PF-5-50
C315	1	21-80341B94	CAPACITOR	.01UF-10-100
C316	1	21-80341B94	CAPACITOR	.01UF-10-100
C317	1	21-80341B94	CAPACITOR	.01UF-10-100
C318	1	21-80341B87	CAPACITOR	62PF-5-50
C319	1	21-80341B94	CAPACITOR	.01UF-10-100
C320	1	20-80396A57	CAPACITOR	9 TO 35PF-200
C323	1	21-80341B94	CAPACITOR	.01UF-10-100
C324	1	21-80341B94	CAPACITOR	.01UF-10-100
C325	1	21-80341B94	CAPACITOR	.01UF-10-100
C326	1	21-80341B94	CAPACITOR	.01UF-10-100
C327	1	20-80343B35	CAPACITOR	5 TO 18PF-200
C328	1	20-80343B35	CAPACITOR	5 TO 18PF-200
C329	1	21-80341B94	CAPACITOR	.01UF-10-100
C330	1	21-80341B94	CAPACITOR	.01UF-10-100
C331	1	21-80341B94	CAPACITOR	.01UF-10-100
C332	1	21-80341B94	CAPACITOR	.01UF-10-100
C333	1	21-80341B66	CAPACITOR	30PF-5-50
C334	1	21-80339B16	CAPACITOR	51PF-5-500
C335	1	21-80341B45	CAPACITOR	100PF-5-50
C337	1	21-80341B94	CAPACITOR	.01UF-10-100
C338	1	21-80341B63	CAPACITOR	24PF-5-50
C339	1	21-80341B54	CAPACITOR	150PF-5-50
C340	1	21-80341B54	CAPACITOR	150PF-5-50
C341	1	21-80341B94	CAPACITOR	.01UF-10-100
C342	1	21-80342B10	CAPACITOR	.1UF-20-50
C343	1	21-80342B10	CAPACITOR	.1UF-20-50
C344	1	21-80339B16	CAPACITOR	51PF-5-500
C345	1	21-80341B45	CAPACITOR	100PF-5-50
C346	1	21-80341B94	CAPACITOR	.01UF-10-100
C347	1	21-80342B10	CAPACITOR	.1UF-20-50
C348	1	21-80342B10	CAPACITOR	.1UF-20-50
C349	1	21-80342B10	CAPACITOR	.1UF-20-50
C350	1	21-80342B10	CAPACITOR	.1UF-20-50
C351	1	21-80342B10	CAPACITOR	.1UF-20-50
C352	1	21-80342B10	CAPACITOR	.1UF-20-50
C353	1	21-80341B48	CAPACITOR	120PF-5-50
C354	1	21-80342B10	CAPACITOR	.1UF-20-50
C355	1	21-80342B10	CAPACITOR	.1UF-20-50
C356	1	21-80342B10	CAPACITOR	.1UF-20-50
C357	1	21-80342B10	CAPACITOR	.1UF-20-50
C358	1	21-80342B10	CAPACITOR	.1UF-20-50
C359	1	23-80341B15	CAPACITOR	10UF-20-50
C360	1	21-80342B10	CAPACITOR	.1UF-20-50
C361	1	21-80341B46	CAPACITOR	1000PF-5-50
C362	1	23-80341B15	CAPACITOR	10UF-20-50
C363	1	21-80341B60	CAPACITOR	220PF-5-50
C364	1	21-80341B88	CAPACITOR	68PF-5-50
C365	1	21-80341B96	CAPACITOR	.1UF-10-100
C366	1	21-80342B43	CAPACITOR	.33UF-10-100
C367	1	21-80341B94	CAPACITOR	.01UF-10-100
C368	1	21-80342B10	CAPACITOR	.1UF-20-50
C369	1	21-80342B10	CAPACITOR	.1UF-20-50
C370	1	21-80341B61	CAPACITOR	.0022UF-5-50
C371	1	23-80341B15	CAPACITOR	10UF-20-50
C372	1	21-80342B10	CAPACITOR	.1UF-20-50
C373	1			
C374	1			
C375	1			
C376	1			
C377	1			
C377	S01			
C377	S01			
C378	1			
C379	1			
C380	1			
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C433	1			
C434	1			
CR101	1			
CR102	1			
CR103	1			
CR201	1			
CR202	1			
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CR204	1			
CR301	1			
CR302	1			
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CR313	1			
CR314	1			
CR315	1			
CR316	1			
CR319	1			
CR320	1			
FL301	1			

st Value	Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
UF-20-50	FL302	1	48-80344B22	FILTER CRYSTAL	10.700 MHZ
F-20-50	FL303	1	48-80340B80	FILTER, CERAMIC, 10.700MHZ	USE RED DOT ONLY
F-S-500	L101	1	24-80369A37	COIL	100UH
PF-S-300	L102	1	24-80369A37	COIL	100UH
PF-S-50 NOMINAL	L103	1	24-80369A37	COIL	100UH
PF-S-50	L104	1	24-80369A37	COIL	100UH
PF-S-50	L201	1	24-80369A40	COIL	560UH
PF-S-50	L202	1	24-80369A44	COIL	4700UH
UF-20-50	L203	1	24-80369A42	COIL	1000UH
UF-20-16	L204	1	24-80369A44	COIL	4700UH
UF-20-50	L205	1	24-80369A42	COIL	1000UH
UF-10-100	L206	1	24-80369A44	COIL	4700UH
UF-20-50	L207	1	24-80369A42	COIL	1000UH
UF-20-50	L301	1	25-80342B83	COIL	3.9UH
UF-20-50	L303	1	24-80369A28	COIL	6.8UH
UF-20-50	L304	1	24-80340B54	COIL	3.3UH
UF-20-50	L305	1	24-80369A29	COIL	10UH
UF-20-50	L306	1	24-80340B56	COIL	18UH
1UF-10-100	L307	1	24-80340B54	COIL	3.3UH
UF-20-50	L308	1	24-80369A29	COIL	10UH
UF-20-50	L309	1	24-80369A31	COIL	22UH
TO 35PF-200	L310	1	24-80369A31	COIL	22UH
UF-20-50	L311	1	24-80340B56	COIL	18UH
500PF-S-50	L312	1	24-80340B59	COIL	33UH
UF-20-50	L314	1	24-80369A29	COIL	10UH
270PF-S-50	L315	1	24-80344B71	COIL	100UH
UF-20-50	L316	1	24-80344B71	COIL	100UH
UF-20-50	L317	1	24-80344B70	COIL	1000UH
UF-20-50	L318	1	24-80340B83	COIL	470UH
9PF-S-50	L319	1	24-80369A42	COIL	1000UH
33PF-S-50	L320	1	24-80369A37	COIL	100UH
270PF-S-50	L321	1	24-80369A37	COIL	100UH
270PF-S-50	L322	1	24-80369A42	COIL	1000UH
27PF-S-50	L323	1	24-80369A42	COIL	1000UH
27PF-S-50	L324	1	24-80369A38	COIL	220UH
47UF-20-16	L325	1	24-80369A38	COIL	220UH
47UF-20-16	Q101	1	48-80340B86	TRANSISTOR	MPS6520
27PF-S-50	Q102	1	48-80340B85	TRANSISTOR	MP6519
200PF-S-50	Q103	1	48-80340B28	TRANSISTOR	
.1UF-20-50	Q104	1	48-80340B30	TRANSISTOR	
150PF-S-50	Q105	1	48-80340B29	TRANSISTOR	
.1UF-20-50	Q201	1	48-80869843	TRANSISTOR	
.47UF-10-100	Q202	1	48-80340B86	TRANSISTOR	MSP6520
.1UF-20-50	Q203	1	48-80340B85	TRANSISTOR	MPS6519
.1UF-20-50	Q204	1	48-80340B86	TRANSISTOR	MPS6520
.1UF-20-50	Q301	1	48-80869933	TRANSISTOR	U310, SCREENED
.1UF-20-50	Q302	1	48-80369A90	TRANSISTOR	
.1UF-20-50	Q303	1	48-80340B86	TRANSISTOR	MPS6520
.1UF-20-50	Q304	1	48-80340B85	TRANSISTOR	MPS6519
.1UF-20-50	Q305	1	48-00869878	TRANSISTOR	
.1UF-20-50	Q306	1	48-00869878	TRANSISTOR	
1UF-20-35	Q307	1	48-00869878	TRANSISTOR	
.1UF-20-50	Q308	1	48-00869878	TRANSISTOR	
.1UF-20-50	Q309	1	48-80340B85	TRANSISTOR	MPS6519
.1UF-20-50	Q310	1	48-80340B86	TRANSISTOR	MPS6520
27PF-S-50	Q311	1	48-80340B86	TRANSISTOR	MPS6520
.01UF-10-100	Q312	1	48-80340B85	TRANSISTOR	MPS6519
470PF-S-50	Q313	1	48-80340B86	TRANSISTOR	MPS6520
.1UF-20-50	Q314	1	48-80340B85	TRANSISTOR	MPS6519
100PF-20-100	Q315	1	48-80340B85	TRANSISTOR	MPS6519
270PF-S-300	Q316	1	48-80340B85	TRANSISTOR	MPS6519
	Q317	1	48-00869878	TRANSISTOR	
	R101	1	06-10521C87	RESISTOR	9.09K-1-1/4
	R102	1	06-10521C91	RESISTOR	10K-1-1/4
	R103	1	06-10521D21	RESISTOR	20K-1-1/4
	R104	1	06-11009C90	RESISTOR	51K-S-1/4
	R105	1	06-10521D21	RESISTOR	20K-1-1/4
	R106	1	06-10521D85	RESISTOR	95.3K-1-1/4
	R107	1	06-10521D68	RESISTOR	61.9K-1-1/4
	R108	1	06-10521E55	RESISTOR	487K-1-1/4
	R109	1	06-10521D31	RESISTOR	25.5K-1-1/4
	R110	1	06-10521C90	RESISTOR	9.76K-1-1/4
	R111	1	06-10521C91	RESISTOR	10K-1-1/4
	R112	1	06-10521C96	RESISTOR	11.3K-1-1/4
	R113	1	06-10521D55	RESISTOR	45.3K-1-1/4
	R114	1	06-11009C73	RESISTOR	10K-S-1/4
	R115	1	06-11009C73	RESISTOR	10K-S-1/4
	R116	1	06-11009C25	RESISTOR	100-S-1/4
	R117	1	06-11009C25	RESISTOR	100-S-1/4
	R118	1	06-11009C95	RESISTOR	82K-S-1/4
	R120	1	06-11009D10	RESISTOR	330K-S-1/4
	R121	1	06-10521C45	RESISTOR	3.32K-1-1/4
	R122	1	06-11009D10	RESISTOR	330K-S-1/4
	R123	1	06-11009D10	RESISTOR	330K-S-1/4
	R124	1	06-11009C56	RESISTOR	2K-S-1/4
) USE RED DOT ONLY	R125	1	06-11009C79	RESISTORS	18K-S-1/4

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R128	1	06-11009C66	RESISTOR	5.1K-S-1/4
R129	1	06-11009C49	RESISTOR	1K-S-1/4
R130	1	06-11009C49	RESISTOR	1K-S-1/4
R131	1	06-11009C53	RESISTOR	1.5K-S-1/4
R132	1	06-10521C91	RESISTOR	10K-1-1/4
R133	1	06-10521C05	RESISTOR	1.27K-1-1/4
R134	1	06-10521C91	RESISTOR	10K-1-1/4
R135	1	06-10521C91	RESISTOR	10K-1-1/4
R136	1	06-10521C91	RESISTOR	10K-1-1/4
R137	1	06-11009C66	RESISTOR	5.1K-S-1/4
R138	1	06-11009C49	RESISTOR	1K-S-1/4
R139	1	06-11009C49	RESISTOR	1K-S-1/4
R140	1	06-10521C45	RESISTOR	3.32K-1-1/4
R141	1	06-10521C05	RESISTOR	1.27-1-1/4
R142	1	06-11009C56	RESISTOR	2K-S-1/4
R143	1	06-11009C56	RESISTOR	2K-S-1/4
R144	1	06-10521C94	RESISTOR	10.7K-1-1/4
R145	1	06-10521C76	RESISTOR	6.98-1-1/4
R146	1	06-10521D63	RESISTOR	54.9K-1-1/4
R147	1	06-10521C39	RESISTOR	2.67K-1-1/4
R148	1	06-80036G18	RESISTOR	5.1-S-1/4
R149	1	06-80036G18	RESISTOR	5.1-S-1/4
R201	1	06-11009C49	RESISTOR	1K-S-1/4
R202	1	06-11009C56	RESISTOR	2K-S-1/4
R203	1	06-11009C46	RESISTOR	750-S-1/4
R204	1	06-00124A45	RESISTOR	680-S-1/4
R205	1	06-80339B75	THERMISTOR	330-10-1/4
R206	1	06-11009C37	RESISTOR	330-S-1/4
R207	1	06-11009C18	RESISTOR	51-S-1/4
R208	1	06-11009C63	RESISTOR	3.9K-S-1/4
R209	1	06-11009C25	RESISTOR	100-S-1/4
R210	1	06-11009C80	RESISTOR	20K-S-1/4
R211	1	06-11009C47	RESISTOR	820-S-1/4
R212	1	06-11009C73	RESISTOR	10K-S-1/4
R213	1	06-11009C59	RESISTOR	2.7K-S-1/4
R214	1	06-11009C73	RESISTOR	10K-S-1/4
R215	1	06-11009C59	RESISTOR	2.7K-S-1/4
R216	1	06-11009C15	RESISTOR	39-S-1/4
R217	1	06-11009C15	RESISTOR	39-S-1/4
R218	1	06-11009C18	RESISTOR	51-S-1/4
R219	1	18-80342B97	RESISTOR, VARIABLE	200
R220	1	06-11009C73	RESISTOR	10K-S-1/4
R221	1	06-11009C59	RESISTOR	2.7K-S-1/4
R222	1	06-11009C73	RESISTOR	10K-S-1/4
R223	1	06-11009C59	RESISTOR	2.7K-S-1/4
R224	1	06-11009C15	RESISTOR	39-S-1/4
R225	1	06-11009C18	RESISTOR	51-S-1/4
R226	1	18-80342B97	RESISTOR, VARIABLE	200
R227	1	06-11009C15	RESISTOR	39-S-1/4
R228	1	06-10521C63	RESISTOR	5.11K-1-1/4
R229	1	18-83452F16	RESISTOR, VARIABLE	20K
R230	1	06-11009C29	RESISTOR	150-S-1/4
R231	1	06-10521C42	RESISTOR	3.09K-1-1/4
R232	1	06-10521D12	RESISTOR	16.2K-1-1/4
R233	1	06-10521C59	RESISTOR	4.64K-1-1/4
R235	1	06-10521B94	RESISTOR	1K-1-1/4
R236	1	06-11009C41	RESISTOR	470-S-1/4
R237	1	06-10521E39	RESISTOR	332K-1-1/4
R238	1	06-11009C61	RESISTOR	3.3K-S-1/4
R239	1	06-10521D21	RESISTOR	20K-1-1/4
R240	1	06-10521D49	RESISTOR	39.2K-1-1/4
R241	1	18-80344B26	RESISTOR, VARIABLE	10K-1K
R242	1	06-10521D21	RESISTOR	20K-1-1/4
R243	1	06-11009C56	RESISTOR	2K-S-1/4
R245	1	06-10521C20	RESISTOR	1.82K-1-1/4
R246	1	06-11009C25	RESISTOR	100-S-1/4
R247	1	06-10521C91	RESISTOR	10K-1-1/4
R248	1	06-10521D21	RESISTOR	20K-1-1/4
R249	1	06-10521C87	RESISTOR	9.09K-1-1/4
R250	1	06-11009C31	RESISTOR	180-S-1/4
R252	1	06-11009C25	RESISTOR	100-S-1/4
R253	1	06-11009C83	RESISTOR	27K-S-1/4
R254	1	06-11009C73	RESISTOR	10K-S-1/4
R255	1	06-11009C49	RESISTOR	1K-S-1/4
R256	1	06-11009C39	RESISTOR	390-S-1/4
R257	1	06-11009C66	RESISTOR	5.1K-S-1/4
R258	1	06-10521C33	RESISTOR	2.49K-1-1/4
R259	1	06-10521E39	RESISTOR	332K-1-1/4
R260	1	06-10521C91	RESISTOR	10K-1-1/4
R261	1	06-10521B90	RESISTOR	909-1-1/4
R262	1	06-10521B82	RESISTOR	750-1-1/4
R264	1	06-11009C18	RESISTOR	51-S-1/4
R301	1	06-11009C18	RESISTOR	51-S-1/4
R302	1	06-11009C18	RESISTOR	51-S-1/4
R303	1	06-11009C29	RESISTOR	150-S-1/4
R304	1	06-11009C49	RESISTOR	1K-S-1/4

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R305	1	06-00124A05	RESISTOR	15-S-1/4
R306	1	06-11009C49	RESISTOR	1K-S-1/4
R307	1	06-11009C05	RESISTOR	15-S-1/4
R308	1	06-11009C29	RESISTOR	150-S-1/4
R309	1	06-11009C29	RESISTOR	150-S-1/4
R310	1	06-11009C47	RESISTOR	820-S-1/4
R311	1	06-11009C47	RESISTOR	820-S-1/4
R313	1	06-11009C47	RESISTOR	820-S-1/4
R314	1	06-11009C73	RESISTOR	10K-S-1/4
R315	1	06-11009C05	RESISTOR	15-S-1/4
R316	1	06-11009C47	RESISTOR	820-S-1/4
R317	1	06-11009C47	RESISTOR	820-S-1/4
R318	1	06-11009C29	RESISTOR	150-S-1/4
R322	1	06-11009C47	RESISTOR	820-S-1/4
R323	1	06-11009C47	RESISTOR	820-S-1/4
R324	1	06-11009C32	RESISTOR	200-S-1/4
R325	1	06-11009C47	RESISTOR	820-S-1/4
R326	1	06-11009C47	RESISTOR	820-S-1/4
R327	1	06-11009C57	RESISTOR	2.2-S-1/4
R328	1	06-11009C56	RESISTOR	2K-S-1/4
R329	1	06-11009C56	RESISTOR	2K-S-1/4
R330	1	06-11009C46	RESISTOR	750-S-1/4
R331	1	06-11009C18	RESISTOR	51-S-1/4
R332	1	06-11009C32	RESISTOR	200-S-1/4
R333	1	06-11009C97	RESISTOR	100K-S-1/4
R334	1	06-11009C73	RESISTOR	10K-S-1/4
R335	1	06-11009C83	RESISTOR	27K-S-1/4
R336	1	06-11009C29	RESISTOR	150-S-1/4
R337	1	06-11009C56	RESISTOR	2K-S-1/4
R338	1	06-11009C56	RESISTOR	2K-S-1/4
R339	1	06-11009C18	RESISTOR	51-S-1/4
R340	1	06-11009C29	RESISTOR	150-S-1/4
R342	1	06-11009C80	RESISTOR	20K-S-1/4
R343	1	06-11009C67	RESISTOR	5.6K-S-1/4
R344	1	06-11009C54	RESISTOR	1.6K-S-1/4
R345	1	06-11009C29	RESISTOR	150-S-1/4
R346	1	06-11009C29	RESISTOR	150-S-1/4
R347	1	06-11009C54	RESISTOR	1.6K-S-1/4
R348	1	06-11009C40	RESISTOR	430-S-1/4
R349	1	06-10621E39	RESISTOR	332K-1-1/4
R350	1	06-11009C29	RESISTOR	150-S-1/4
R351	1	06-10621E39	RESISTOR	332K-1-1/4
R352	1	06-11009C67	RESISTOR	5.6K-S-1/4
R354	1	06-10621D80	RESISTOR	82.5K-1-1/4
R355	1	06-10621D24	RESISTOR	20.5K-1-1/4
R356	1	06-11009D02	RESISTOR	150K-S-1/4
R357	1	06-11009D02	RESISTOR	150K-S-1/4
R358	1	06-11009C80	RESISTOR	20K-S-1/4
R359	1	18-80342B96	RESISTOR, VARIABLE	10K
R360	1	06-10621D64	RESISTOR	56.2K-1-1/4
R361	1	06-10621D28	RESISTOR	23.7K-1-1/4
R362	1	06-11009C28	RESISTOR	130-S-1/4
R363	1	06-11009C28	RESISTOR	130-S-1/4
R364	1	06-11009C18	RESISTOR	51-S-1/4
R365	1	06-11009C23	RESISTOR	82-S-1/4
R366	1	06-11009C60	RESISTOR	3K-S-1/4
R367	1	06-11009C66	RESISTOR	5.1K-S-1/4
R368	1	06-11009C90	RESISTOR	51K-S-1/4
R369	1	06-11009C90	RESISTOR	51K-S-1/4
R370	1	06-11009C29	RESISTOR	150-S-1/4
R371	1	06-11009C49	RESISTOR	1K-S-1/4
R372	1	06-11009C32	RESISTOR	200-S-1/4
R373	1	06-00124A18	RESISTOR	51-S-1/4
R374	1	06-00124A32	RESISTOR	200-S-1/4
R375	1	06-11009C90	RESISTOR	51K-S-1/4
R376	1	06-11009C56	RESISTOR	2K-S-1/4
R377	1	06-11009C15	RESISTOR	39-S-1/4
R378	1	06-11009C22	RESISTOR	75-S-1/4
R379	1	06-11009C15	RESISTOR	39-S-1/4
R380	1	06-11009B05	RESISTOR	200K-S-1/4
R381	1	06-11009C83	RESISTOR	27K-S-1/4
R382	1	06-11009C94	RESISTOR	75K-S-1/4
R383	1	06-11009C90	RESISTOR	51K-S-1/4
R384	1	06-11009C49	RESISTOR	1K-S-1/4
R385	1	06-11009D19	RESISTOR	750K-S-1/4
R386	1	06-11009C49	RESISTOR	1K-S-1/4
R388	1	06-11009C66	RESISTOR	5.1K-S-1/4
R389	1	06-11009C63	RESISTOR	3.9K-S-1/4
R390	1	06-11009C56	RESISTOR	2K-S-1/4
R391	1	06-11009C59	RESISTOR	2.7K-S-1/4
R392	1	06-11009C58	RESISTOR	2.4K-S-1/4
R393	1	06-10621D28	RESISTOR	23.7K-1-1/4
R394	1	06-10621D80	RESISTOR	82.5K-1-1/4
R395	1	06-11009C73	RESISTOR	10K-S-1/4
R396	1	06-11009D02	RESISTOR	150K-S-1/4
R397	1	06-11009C73	RESISTOR	10K-S-1/4
R398	1	18-80342B96	RESISTOR, VARIABLE	10K
R399	1	06-11009C32	RESISTOR	200-S-1/4
R400	1	06-11009C42	RESISTOR	510-S-1/4
R401	1	06-11009C42	RESISTOR	510-S-1/4
R402	1	06-11009C36	RESISTOR	300-S-1/4
R403	1	06-11009C51	RESISTOR	1.2K-S-1/4
R404	1	06-11009C46	RESISTOR	750-S-1/4
R405	1	06-11009C47	RESISTOR	820-S-1/4
R406	1	06-11009C88	RESISTOR	43K-S-1/4
R407	1	06-11009C66	RESISTOR	5.1K-S-1/4
R408	1	06-11009C66	RESISTOR	5.1K-S-1/4
R409	1	06-10621C95	RESISTOR	11K-1-1/4
R410	1	06-10621C95	RESISTOR	11K-1-1/4
R411	1	06-11009C46	RESISTOR	750-S-1/4
R412	1	06-11009C46	RESISTOR	750-S-1/4
R413	1	06-10621C91	RESISTOR	10K-1-1/4
R414	1	06-10621C91	RESISTOR	10K-1-1/4
R415	1	06-10621C91	RESISTOR	10K-1-1/4
R416	1	06-10621C91	RESISTOR	10K-1-1/4
R417	1	06-10621D76	RESISTOR	75K-1-1/4
R418	1	06-10621D76	RESISTOR	75K-1-1/4
R420	1	06-11009C73	RESISTOR	10K-S-1/4
R421	1	18-80342B98	RESISTOR, VARIABLE	2K
R422	1	06-10621C87	RESISTOR	9.09K-1-1/4
R423	1	06-10621C91	RESISTOR	10K-1-1/4
R424	1	06-11009D04	RESISTOR	180K-S-1/4
R425	1	06-11009C90	RESISTOR	51K-S-1/4
R426	1	06-11009C67	RESISTOR	5.6K-S-1/4
R427	1	06-11009D11	RESISTOR	360K-S-1/4
R428	1	06-11009C56	RESISTOR	2K-S-1/4
R429	1	06-11009C29	RESISTOR	150-S-1/4
R430	1	06-11009C90	RESISTOR	51K-S-1/4
R431	1	06-11009C83	RESISTOR	27K-S-1/4
R432	1	06-11009C80	RESISTOR	20K-S-1/4
R433	1	06-11009C66	RESISTOR	5.1K-S-1/4
R434	1	06-11009C37	RESISTOR	330-S-1/4
R435	1	06-00124A61	RESISTOR	3.3K-S-1/4
R436	1	06-10621D27	RESISTOR	23.2K-1-1/4
R437	1	06-10621D32	RESISTOR	26.1K-1-1/4
R438	1	06-11009C83	RESISTOR	27K-S-1/4
R439	1	06-11009C90	RESISTOR	51K-S-1/4
R440	1	06-11009C63	RESISTOR	3.9K-S-1/4
R441	1	06-11009D20	RESISTOR	820K-S-1/4
R442	1	06-11009C56	RESISTOR	2K-S-1/4
R443	1	06-11009C80	RESISTOR	20K-S-1/4
R444	1	06-11009C73	RESISTOR	10K-S-1/4
R445	1	06-11009C23	RESISTOR	82-S-1/4
R447	1	06-11009C23	RESISTOR	82-S-1/4
R448	1	06-00124A73	RESISTOR	10K-S-1/4
R449	1	06-11009C32	RESISTOR	200-S-1/4
R450	1	06-11009C75	RESISTOR	12K-S-1/4
R451	1	06-11009C66	RESISTOR	5.1K-S-1/4
T301	1	25-80342B84	TRANSFORMER	
T302	1	25-80342B78	TRANSFORMER	
T303	1	25-80342B76	TRANSFORMER	
T304	1	25-80342B81	TRANSFORMER	
T305	1	25-80342B76	TRANSFORMER	
U101	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U102	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U103	1	51-80339B99	INTEGRATED CIRCUIT	
U104	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U105	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U106	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U107	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U108	1	51-80339B99	INTEGRATED CIRCUIT	
U111	1	51-80396A16	INTEGRATED CIRCUIT	LM324N SCREENED
U112	1	51-83627M42	INTEGRATED CIRCUIT	
U113	1	51-83627M42	INTEGRATED CIRCUIT	
U114	1	51-80345A05	INTEGRATED CIRCUIT	HI-201-5 SCREENED
U115	1	51-05469E13	INTEGRATED CIRCUIT	
U201	1	51-83222M02	INTEGRATED CIRCUIT	
U202	1	51-80365A15	INTEGRATED CIRCUIT	
U203	1	51-80365A15	INTEGRATED CIRCUIT	
U204	1	51-80368A65	INTEGRATED CIRCUIT	TL441CN SCREENED
U205	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U206	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U207	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U301	1	51-80340B20	INTEGRATED CIRCUIT	
U302	1	51-83222M02	INTEGRATED CIRCUIT	
U303	1	51-80339B06	INTEGRATED CIRCUIT	
U304	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U305	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U306	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U307	1	51-80365A15	INTEGRATED CIRCUIT	
U308	1	51-80347A38	INTEGRATED CIRCUIT	
U309	1	51-80347A38	INTEGRATED CIRCUIT	
U310	1	51-80340B24	INTEGRATED CIRCUIT	
U311	1	51-05722G02	INTEGRATED CIRCUIT	

Nomenclature	Part Value
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	CA3240E SCREENED
INTEGRATED CIRCUIT	HI-201-5 SCREENED
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
DIODE	6.2V-5-500MW
DIODE	6.2V-5-500MW
DIODE	6.2V-5-500MW
CRYSTAL	10.24 MHZ

RECEIVER BOARD (A8)

(RTL-1019A)

Figure 10-3b. Printed Wiring Board Assembly and Parts List (Sheet 4 of 4)

10-21 / 10-22 blank

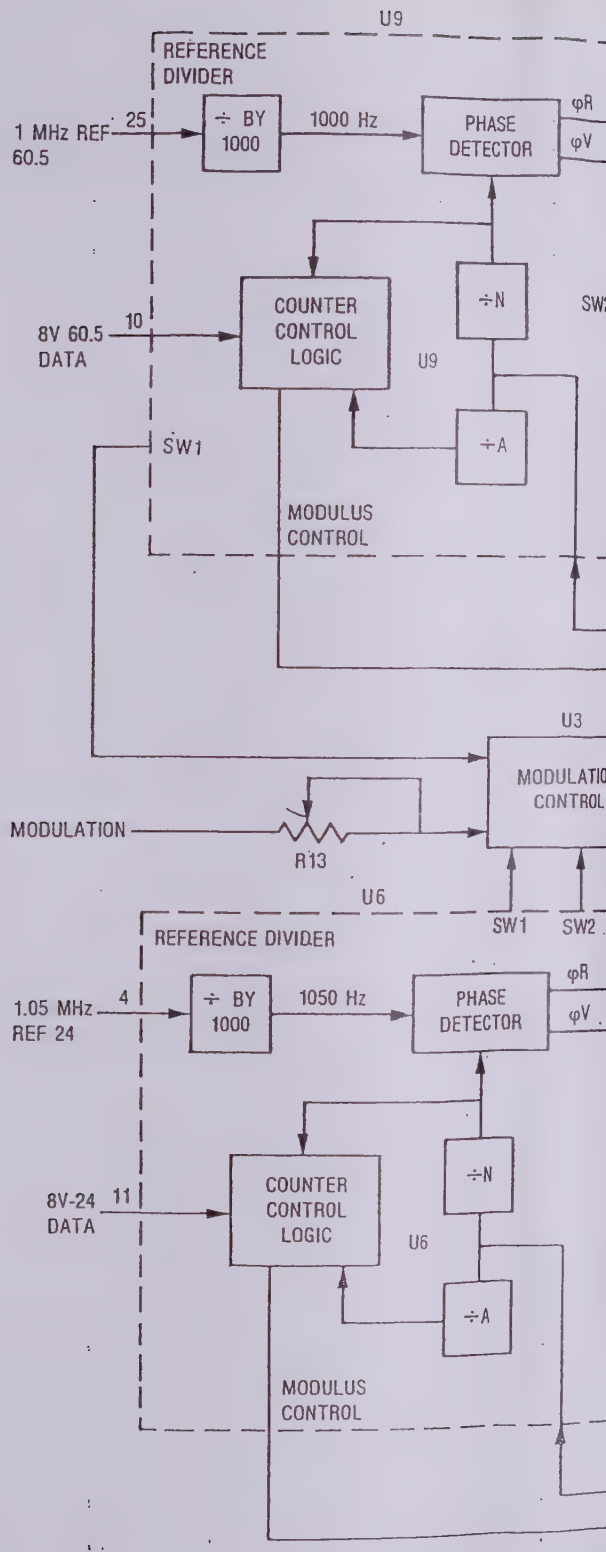
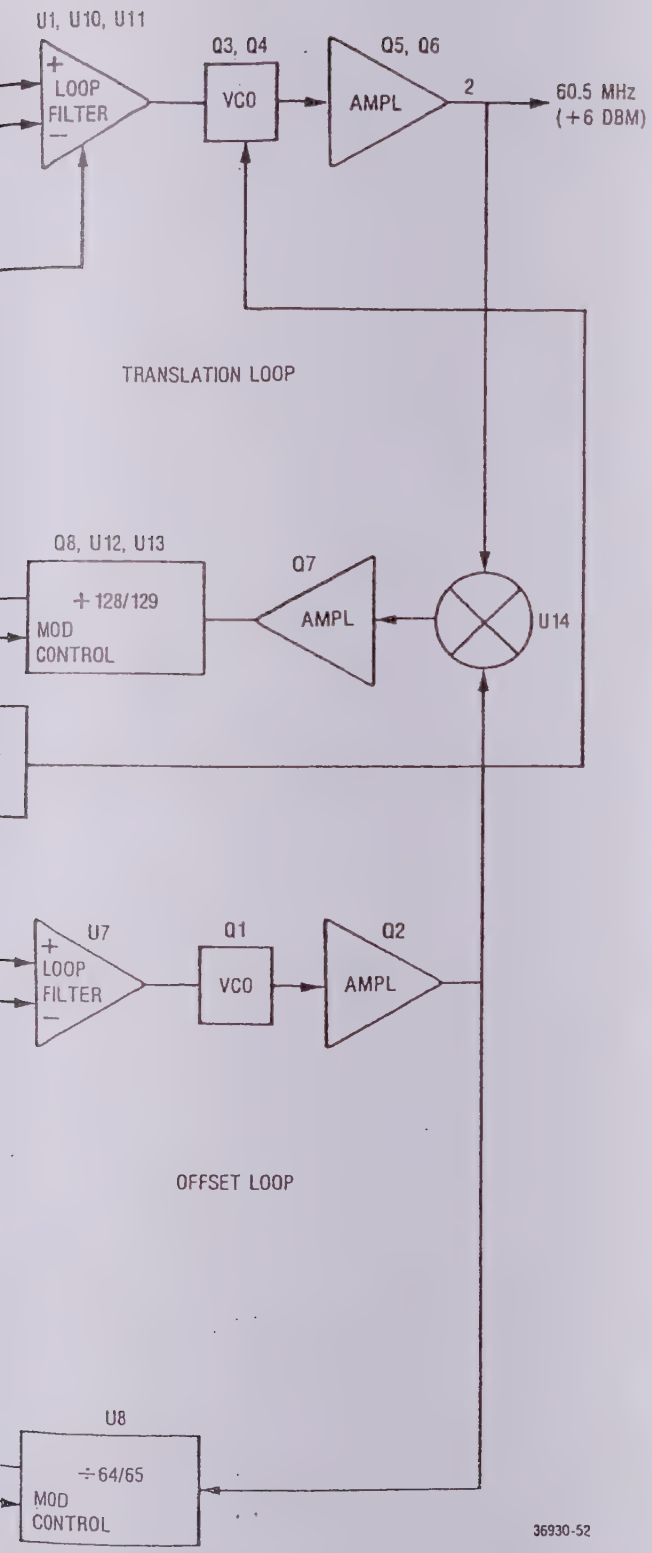

U9
REFERENCE
DIVIDER
1 MHz REF
60.5
25
÷ BY
1000
1000 Hz
PHASE
DETECTOR
φR
φV
COUNTER
CONTROL
LOGIC
÷N
8V 60.5
DATA
10
U9
÷A
SW1
MODULUS
CONTROL
U3
MODULATIO
CONTROL
MODULATION
R13
U6
SW1
SW2
REFERENCE DIVIDER
1.05 MHz
REF 24
4
÷ BY
1000
1050 Hz
PHASE
DETECTOR
φR
φV
8V-24
DATA
11
COUNTER
CONTROL
LOGIC
÷N
U6
÷A
MODULUS
CONTROL

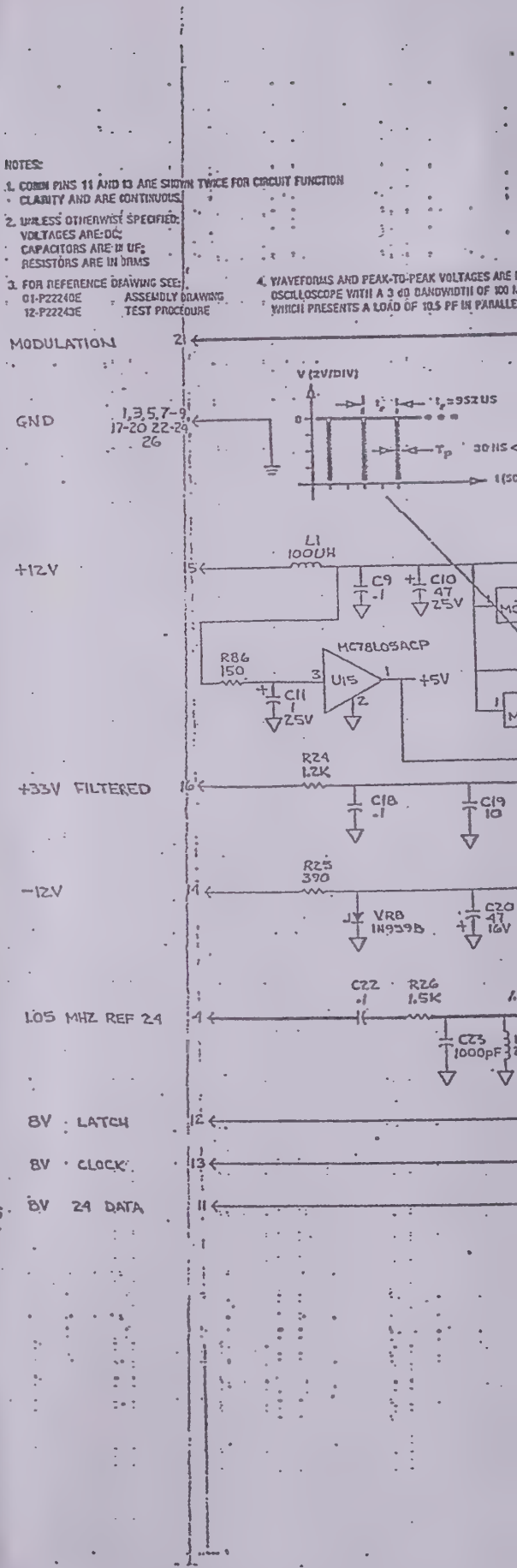
Figure 11-12. Block Diagram



60.5-MHz LOOP BOARD (A9A4)

(RTC-4042A)

Figure 11-13a. Schematic (Sheet 1 of 2)

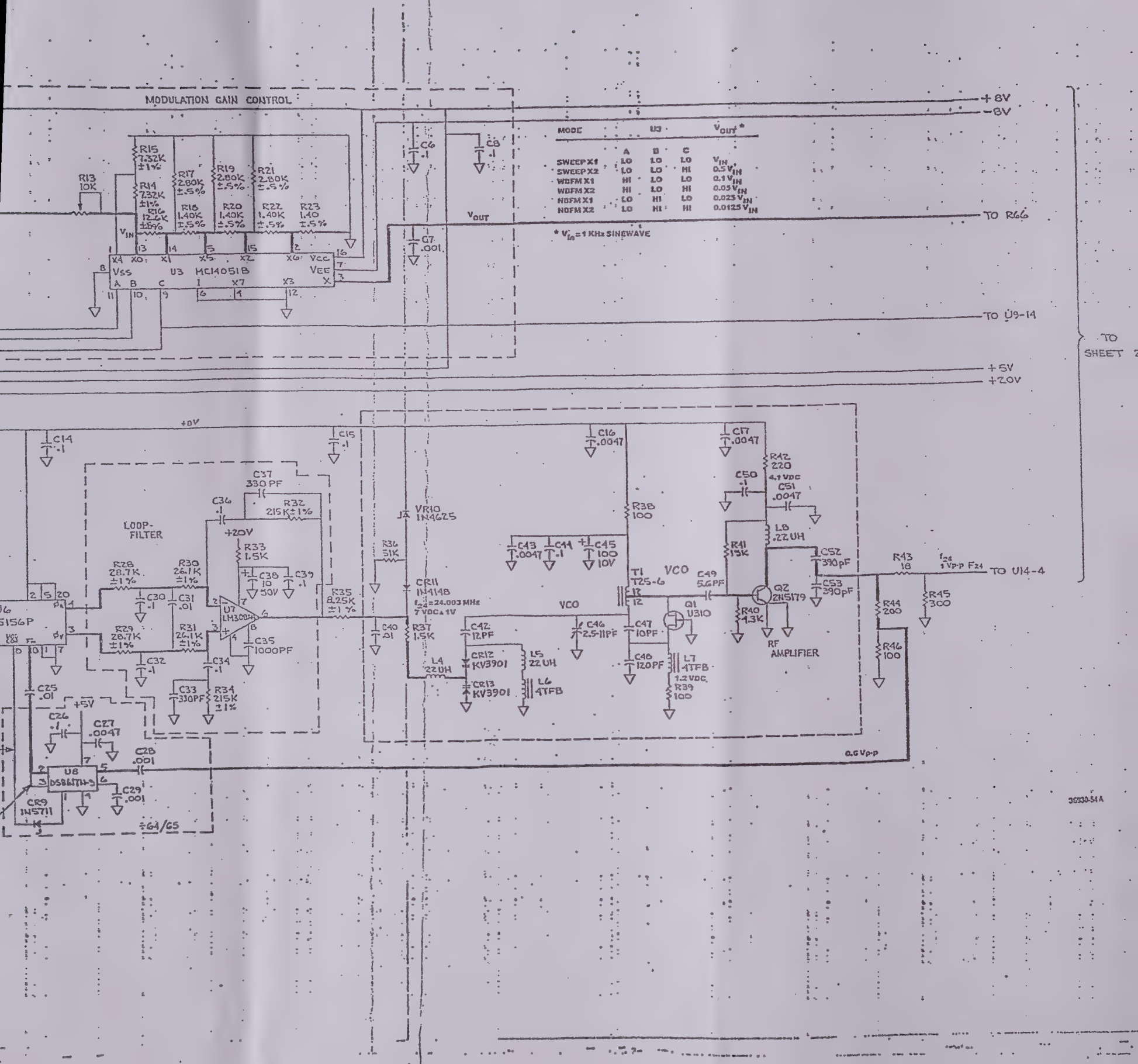


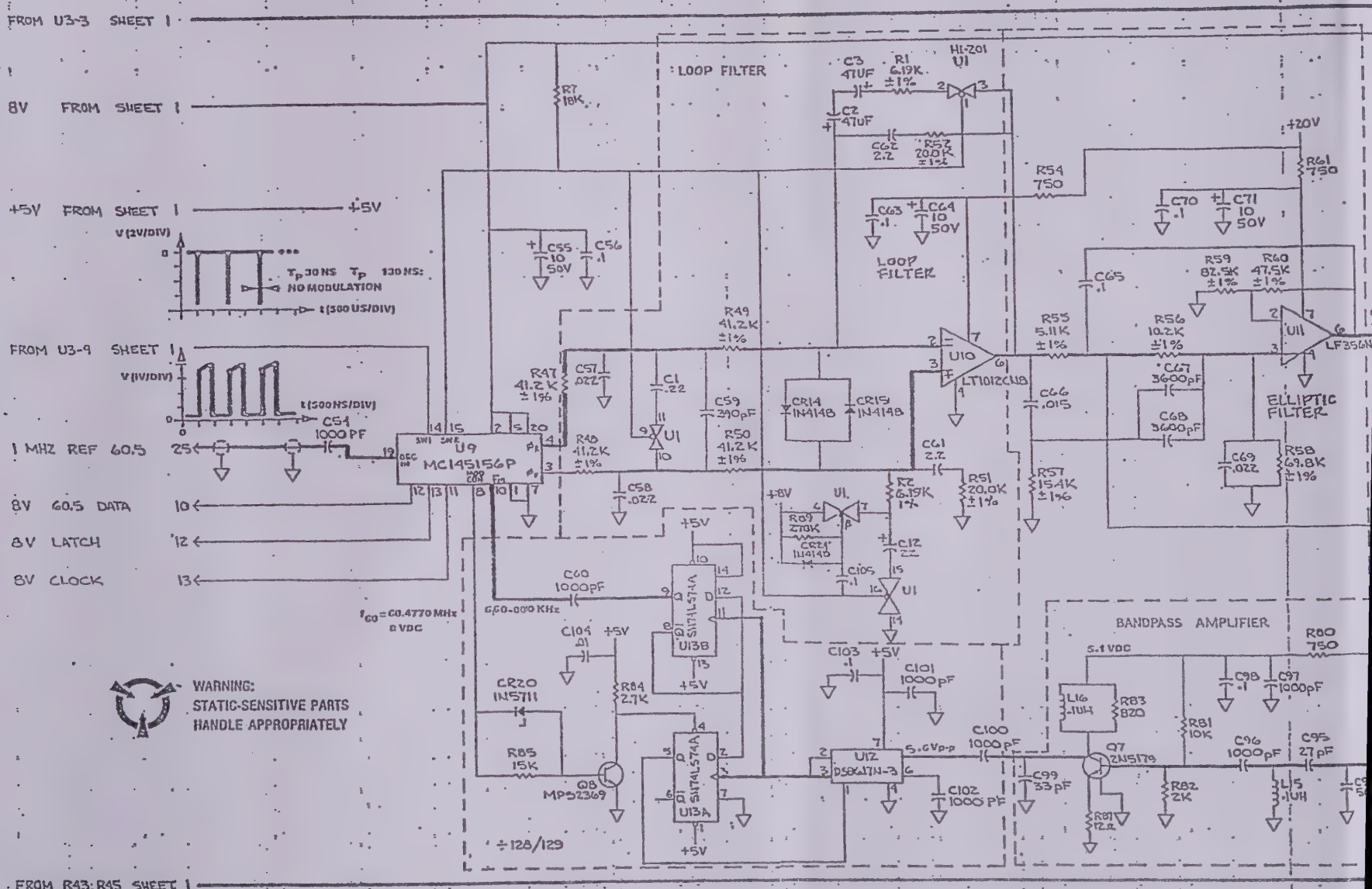
LAST USED	NOT USED
C105	C5,C41,C72
CR21	CR1-4,CR7,CR8,CR9, CR15
L16	L2
Q8	
R87	R3,R8-12
T2	
U15	U2
VR16	VR1-4,VR9,VR11-15
Y1	

REF DES	DEVICE	GND	+V	-V	NO CONNECT
U1	HI-201	1,5	13		12
U2					
U3	MC14051BCP	6,8,12	16	7	
U4	MC78M08CG	3	1		
U5	MC78M08CG	3	1		
U6	MC14515CP	1,7	25,20		4,9,16,17,18
U7	LM308AN	4	7		1,5
U8	DS8617N-3	4	7		8
U9	MC14515CP	1,7	25,20		4,9,16,17,18
U10	LT1012CN8	4	7		1,5,8
U11	LF356N	4	7		1,5,8
U12	DS8617N-3	4	7		8
U13	SN74LS74A	7	9,10 13,14		6
U14	ASK-1-XLS	6			
U15	MC78L05ACP	2	3		

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

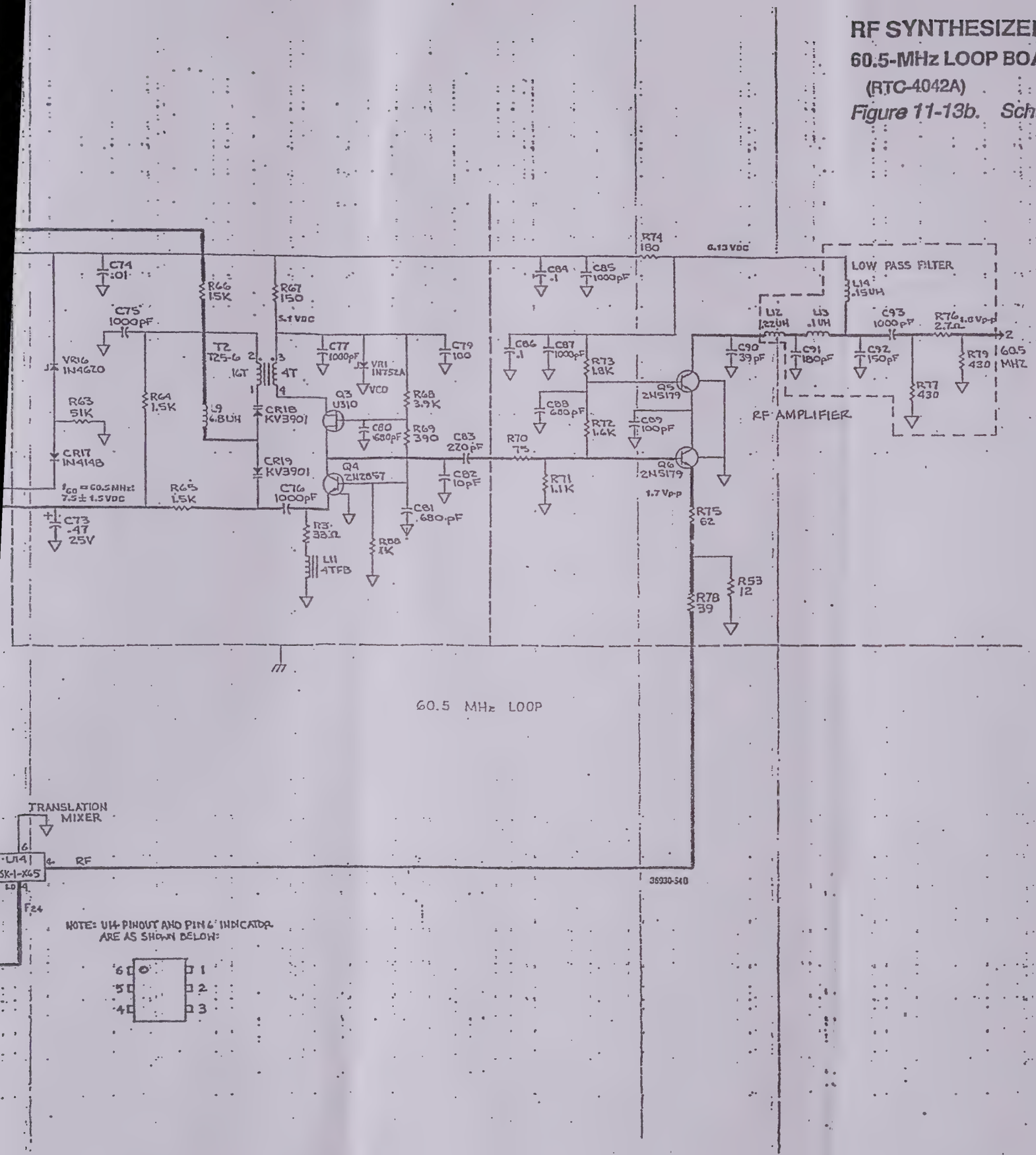
11-22


MODULATION GAIN CONTROL
+8V
-8V
R13 10K
R15 7.32K ±1%
R14 7.32K ±1%
R16 12.4K ±1%
R17 2.80K ±.5%
R18 1.40K ±.5%
R19 2.80K ±.5%
R20 1.40K ±.5%
R21 2.80K ±.5%
R22 1.40K ±.5%
R23 1.40 ±.5%
C6 .1
C8 .1
C7 .001
VIN
VOUT
U3 MC14051B
Vss
Vcc
VEE
MODE
U3
VOUT *
SWEEP X1 LO LO LO VIN
SWEEP X2 LO LO HI 0.5 VIN
WBFM X1 HI LO LO 0.1 VIN
WBFM X2 HI LO HI 0.05 VIN
NBFM X1 LO HI LO 0.025 VIN
NBFM X2 LO HI HI 0.0125 VIN
* Vin = 1 KHz SINEWAVE
TO R66
TO U9-14
TO SHEET 2
+5V
+2.0V
+8V
C14 .1
C15 .1
C16 .0047
C17 .0047
R42 220
4.1 VDC
C50 .1
C51 .0047
L8 .22 UH
R41 15K
C52 390 pF
C53 390 pF
R43 18
f24 1 Vp-p F24
TO U14-4
R44 200
R45 300
R46 100
C37 330 PF
C36 .1
R32 215K ±1%
LOOP-FILTER
+20V
R33 1.5K
C38 10 50V
C39 .1
R28 28.7K ±1%
R30 26.1K ±1%
R29 28.7K ±1%
R31 26.1K ±1%
C30 .1
C31 .01
C32 .1
C34 .1
C35 1000PF
U7 LM300H
R35 8.25K ±1%
VR10 IN4625
R36 51K
CR11 IN4148
fo = 24.003 MHz
7 VDC ± 1V
C40 .01
R37 1.5K
C42 12 PF
CR12 KV3901
CR13 KV3901
L5 22 UH
L6 4TFB
L4 22 UH
VCO
C46 2.5-11PF
C47 10PF
C48 120PF
L7 4TFB
1.2 VDC
R39 100
Q1 U310
R38 100
C43 .0047
C44 .1
C45 100 10V
T1 T25-6
C49 5.6PF
Q2 2N5179
R40 1.3K
RF AMPLIFIER
0.6 Vp-p
C25 .01
C33 330PF
R34 215K ±1%
C26 .1
C27 .0047
C28 .001
U8 DS8617N-3
C29 .001
CR9 IN5711
÷64/65
30930-54A

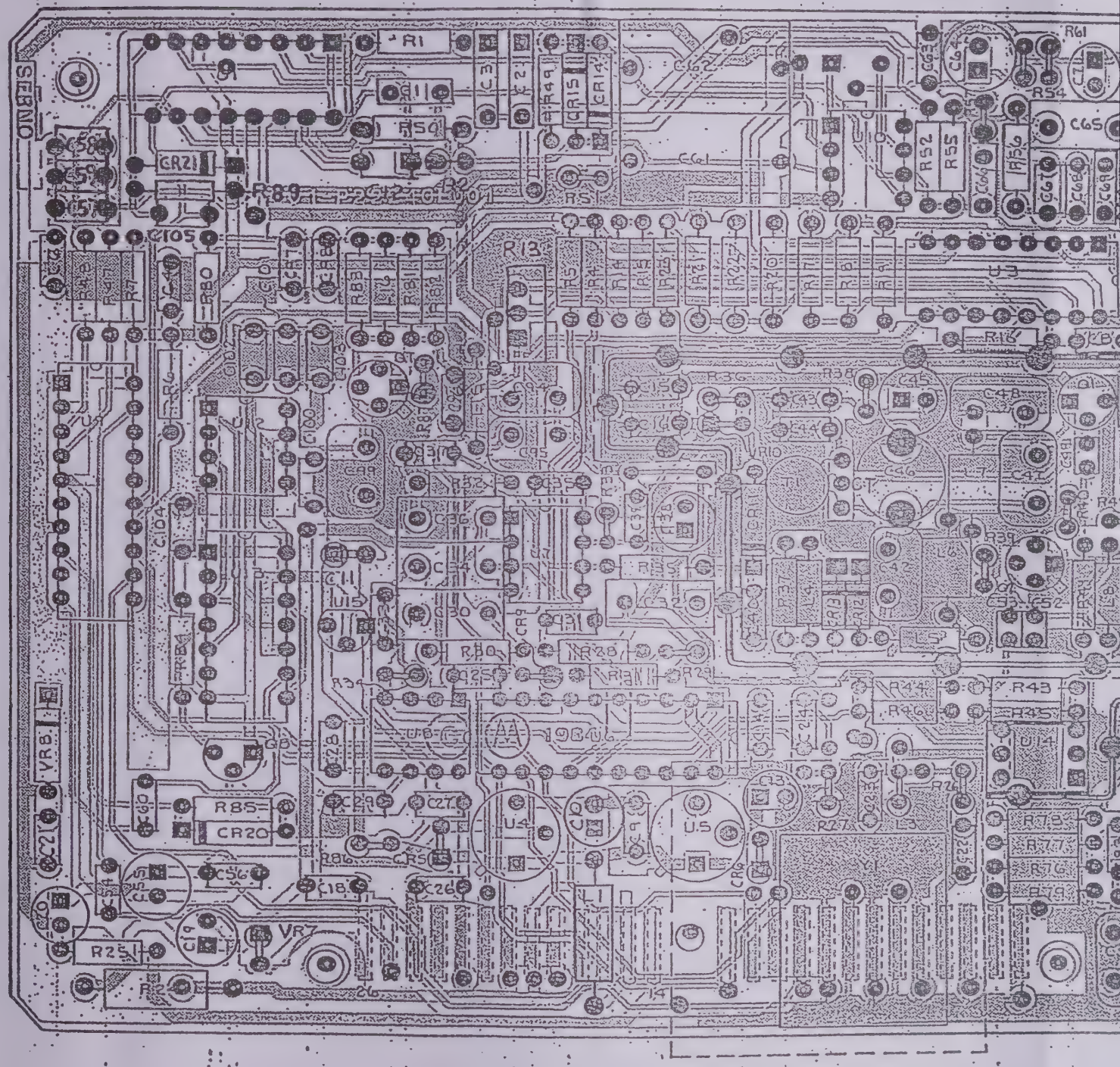

FROM U3-3 SHEET 1
8V FROM SHEET 1
+5V FROM SHEET 1
FROM U3-9 SHEET 1
1 MHZ REF 60.5
8V 60.5 DATA
8V LATCH
8V CLOCK
FROM R43;R45 SHEET 1
LOOP FILTER
BANDPASS AMPLIFIER
ELLIPTIC FILTER
MC145156P
HI-201
LT1012CN8
LF356N
SN74LS74A
DS8417N-3
MPS2369
2N5179
1N4148
1N5711
÷128/129
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

RF SYNTHESIZER MODULE
60.5-MHz LOOP BOARD (A9A4)
(RTC-4042A)

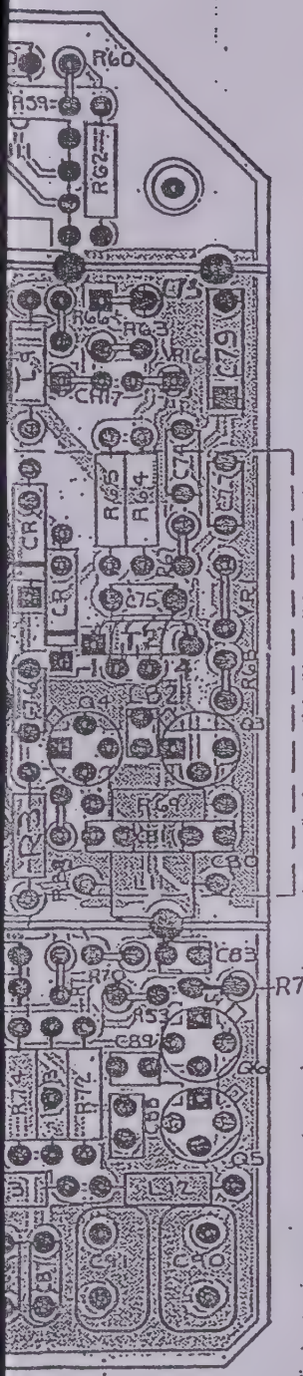
Figure 11-13b. Schematic (Sheet 2 of 2)



11-23 / 11-24 blank



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.



60.5-MHz LOOP BOARD (A9A4)
RTC-4042A

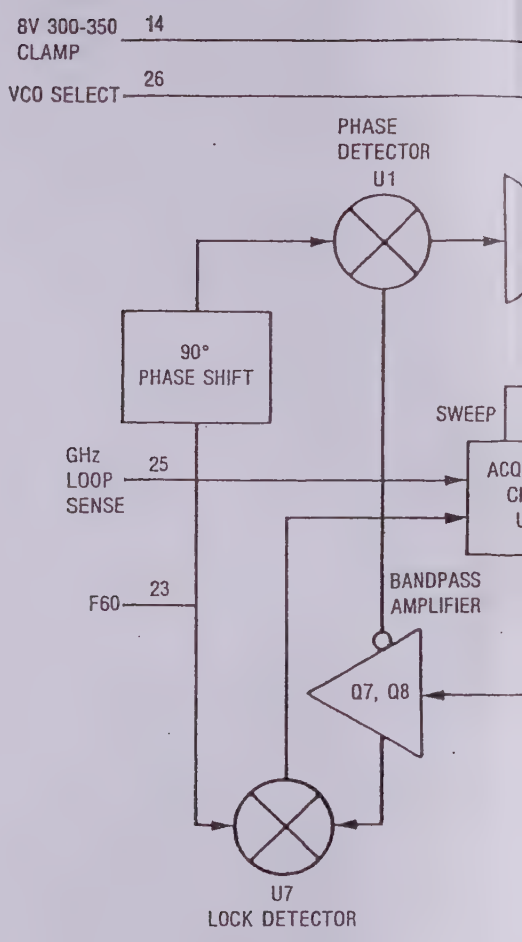
Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C001	1	21-80342B42	CAPACITOR	.22-10-100
C002	1	23-80340B33	CAPACITOR	47UF-10-20
C003	1	23-80340B33	CAPACITOR	47UF-10-20
C004	1	21-80342B10	CAPACITOR	.1UF-20-50
C005	1	21-80342B10	CAPACITOR	.1UF-20-50
C007	1	21-80341B92	CAPACITOR	1000PF-10-100
C008	1	21-80342B10	CAPACITOR	.1UF-20-50
C009	1	21-80342B10	CAPACITOR	.1UF-20-50
C010	1	23-80341B13	CAPACITOR	47UF-20-25
C011	1	23-80340B96	CAPACITOR	1.0UF-20-25
C012	1	23-80340B36	CAPACITOR	22UF-10-15
C013	1	23-80341B15	CAPACITOR	10UF-20-50
C014	1	21-80342B10	CAPACITOR	.1UF-20-50
C015	1	21-80342B10	CAPACITOR	.1UF-20-50
C016	1	21-80342B05	CAPACITOR	4700PF-20-100
C017	1	21-80342B05	CAPACITOR	4700PF-20-100
C018	1	21-80342B10	CAPACITOR	.1UF-20-50
C019	1	23-80341B15	CAPACITOR	10UF-20-50
C020	1	23-80341B11	CAPACITOR	47UF-20-15
C021	1	21-80342B10	CAPACITOR	.1UF-20-50
C022	1	21-80342B10	CAPACITOR	.1UF-20-50
C023	1	21-80341B46	CAPACITOR	1000PF-5-50
C024	1	21-80341B93	CAPACITOR	1000PF-20-100
C025	1	21-80342B09	CAPACITOR	.01UF-20-50
C026	1	21-80342B10	CAPACITOR	.1UF-20-50
C027	1	21-80342B06	CAPACITOR	4700PF-20-100
C028	1	21-80341B93	CAPACITOR	1000PF-20-100
C029	1	21-80341B93	CAPACITOR	1000PF-20-100
C030	1	08-80343B12	CAPACITOR	.1UF-10-100
C031	1	21-80341B94	CAPACITOR	.01UF-10-100
C032	1	08-80343B12	CAPACITOR	.1UF-10-100
C033	1	21-80341B70	CAPACITOR	330PF-10-50
C034	1	08-80343B12	CAPACITOR	.1UF-10-100
C035	1	21-80341B93	CAPACITOR	1000PF-20-100
C036	1	08-80343B12	CAPACITOR	.1UF-10-100
C037	1	21-80341B70	CAPACITOR	330PF-10-50
C038	1	23-80341B15	CAPACITOR	10UF-20-50
C039	1	21-80342B10	CAPACITOR	.1UF-20-50
C040	1	21-80341B94	CAPACITOR	.01UF-10-100
C042	1	21-80339B12	CAPACITOR	12PF-5-500
C043	1	21-80341B84	CAPACITOR	.0047UF-10-050
C044	1	21-80342B10	CAPACITOR	.1UF-20-50
C045	1	23-80341B07	CAPACITOR	100UF-20-10
C046	1	20-80343B36	CAPACITOR	2.5 TO 11PF-350-NPO
C047	1	21-00859934	CAPACITOR	10PF-.5PF-500
C048	1	21-80339B25	CAPACITOR	120PF-5-500
C049	1	21-80339B62	CAPACITOR	5.6PF-10-200
C050	1	21-80342B10	CAPACITOR	.1UF-20-50
C051	1	21-80342B06	CAPACITOR	4700PF-20-100
C052	1	21-80339B66	CAPACITOR	390PF-5-100
C053	1	21-80339B66	CAPACITOR	390PF-5-100
C054	1	21-80341B93	CAPACITOR	1000PF-20-100
C055	1	23-80341B15	CAPACITOR	10UF-20-50
C056	1	21-80342B10	CAPACITOR	.1UF-20-50
C057	1	21-80342B39	CAPACITOR	.022UF-5-50
C058	1	21-80342B39	CAPACITOR	.022UF-5-50
C059	1	21-80341B79	CAPACITOR	390PF-10-50
C060	1	21-80341B93	CAPACITOR	1000PF-20-100
C061	1	08-80343B16	CAPACITOR	2.2UF-5-100
C062	1	08-80343B16	CAPACITOR	2.2UF-5-100
C063	1	21-80342B10	CAPACITOR	.1UF-20-50
C064	1	23-80341B15	CAPACITOR	10UF-20-50
C065	1	08-80343B12	CAPACITOR	.1UF-10-100
C066	1	21-80342B34	CAPACITOR	.015UF-5-50
C067	1	21-80341B73	CAPACITOR	3600PF-5-50
C068	1	21-80341B73	CAPACITOR	3600PF-5-50
C069	1	21-80342B39	CAPACITOR	.022UF-5-50
C070	1	21-80342B10	CAPACITOR	.1UF-20-50
C071	1	23-80341B15	CAPACITOR	10UF-20-50
C073	1	23-80341B01	CAPACITOR	.47UF-5-25
C074	1	21-80342B09	CAPACITOR	.01UF-20-50
C075	1	21-80341B46	CAPACITOR	1000PF-5-50
C076	1	21-80341B46	CAPACITOR	1000PF-5-50
C077	1	21-80341B46	CAPACITOR	1000PF-5-50
C079	1	23-80340B32	CAPACITOR	100UF-10-20
C080	1	21-80339B69	CAPACITOR	680PF-10-100
C081	1	21-80339B69	CAPACITOR	680PF-10-100
C082	1	21-80339B50	CAPACITOR	10PF-10-200
C083	1	21-80339B61	CAPACITOR	220PF-10-100
C084	1	21-80342B10	CAPACITOR	.1UF-20-50
C085	1	21-80341B93	CAPACITOR	1000PF-20-100

Figure 11-14. Printed Wiring Board Assembly and Parts List

Find No.	Qty. Reg.	Part No.	Nomenclature	Part Value
C086	1	21-80342B10	CAPACITOR	.1UF-20-50
C087	1	21-80341B93	CAPACITOR	1000PF-20-100
C088	1	21-80339B69	CAPACITOR	680PF-10-100
C089	1	21-80339B63	CAPACITOR	100PF-10-200
C090	1	21-80339B15	CAPACITOR	39PF-5-500
C091	1	21-80369A95	CAPACITOR	180PF-5-500
C092	1	21-80369A94	CAPACITOR	150PF-5-500
C093	1	21-80341B46	CAPACITOR	1000PF-5-50
C094	1	21-80339B17	CAPACITOR	56PF-5-500
C095	1	21-80369A89	CAPACITOR	27PF-5-500
C096	1	21-80341B46	CAPACITOR	1000PF-5-50
C097	1	21-80341B93	CAPACITOR	1000PF-20-100
C098	1	21-80342B10	CAPACITOR	.1UF-20-50
C099	1	21-80369A90	CAPACITOR	33PF-5-500
C100	1	21-80341B46	CAPACITOR	1000PF-5-50
C101	1	21-80341B93	CAPACITOR	1000PF-20-100
C102	1	21-80341B93	CAPACITOR	1000PF-20-100
C103	1	21-80342B10	CAPACITOR	.1UF-20-50
C104	1	21-80342B09	CAPACITOR	.01UF-20-50
C105	1	21-80342B10	CAPACITOR	.1UF-20-50
CR005	1	48-82466H13	DIODE	
CR006	1	48-82466H13	DIODE	
CR009	1	48-87643C01	DIODE	
CR011	1	48-84463K02	DIODE	
CR012	1	48-80339B95	DIODE	
CR013	1	48-80339B95	DIODE	
CR014	1	48-84463K02	DIODE	
CR015	1	48-84463K02	DIODE	
CR017	1	48-84463K02	DIODE	
CR018	1	48-80339B95	DIODE	
CR019	1	48-80339B95	DIODE	
CR020	1	48-87643C01	DIODE	
CR021	1	48-84463K02	DIODE	
L001	1	24-80369A37	COIL	100UH
L003	1	24-80369A31	COIL	22UH
L004	1	24-80369A31	COIL	22UH
L005	1	24-80369A31	COIL	22UH
L006	1	24-93961B01	CHOKE	
L007	1	24-83961B01	CHOKE	
L008	1	24-80369A25	COIL	.22UH
L009	1	24-80369A28	COIL	6.8UH
L011	1	24-83961B01	CHOKE	
L012	1	24-80369A25	COIL	.22UH
L013	1	24-80369A19	COIL	.1UH
L014	1	24-80369A23	COIL	.15UH
L015	1	24-80369A19	COIL	.1UH
L016	1	24-80369A19	COIL	.1UH
Q001	1	48-00869933	TRANSISTOR	J-FET
Q002	1	48-00869776	TRANSISTOR	
Q003	1	48-00869933	TRANSISTOR	J-FET
Q004	1	48-80342B48	TRANSISTOR	
Q005	1	48-00869776	TRANSISTOR	
Q006	1	48-00869776	TRANSISTOR	
Q007	1	48-00869776	TRANSISTOR	
Q008	1	48-80340B46	TRANSISTOR	
R001	1	06-10621C71	RESISTOR	6190-1-1/4
R002	1	06-10621C71	RESISTOR	6190-1-1/4
R003	1	06-11009C13	RESISTOR	33-5-1/4
R004	1	06-11009C79	RESISTOR	18K-5-1/4
R005	1	06-11009C79	RESISTOR	18K-5-1/4
R006	1	06-11009C79	RESISTOR	18K-5-1/4
R007	1	06-11009C79	RESISTOR	18K-5-1/4
R013	1	18-80343B79	RESISTOR, VARIABLE	10K
R014	1	06-10621C78	RESISTOR	7.32K-1-1/4
R015	1	06-10621C78	RESISTOR	7.32K-1-1/4
R016	1	06-80340B73	RESISTOR	12.6K-5-1/10
R017	1	06-11040C38	RESISTOR	2.80K-5-1/10
R018	1	06-11040C09	RESISTOR	1.40K-5-1/10
R019	1	06-11040C38	RESISTOR	2.80K-5-1/10
R020	1	06-11040C09	RESISTOR	1.40K-5-1/10
R021	1	06-11040C38	RESISTOR	2.80K-5-1/10
R022	1	06-11040C09	RESISTOR	1.40K-5-1/10
R023	1	06-11040C09	RESISTOR	1.40K-5-1/10
R024	1	06-11009C51	RESISTOR	1.2K-5-1/4
R025	1	06-11009C39	RESISTOR	390-5-1/4
R026	1	06-11009C53	RESISTOR	1.5K-5-1/4
R027	1	06-11009C53	RESISTOR	1.5K-5-1/4
R028	1	06-10621D36	RESISTOR	28.7K-1-1/4
R029	1	06-10621D36	RESISTOR	28.7K-1-1/4
R030	1	06-10621D32	RESISTOR	26.1K-1-1/4
R031	1	06-10621D32	RESISTOR	26.1K-1-1/4
R032	1	06-10621E21	RESISTOR	215K-1-1/4
R033	1	06-11009C53	RESISTOR	1.5K-5-1/4
R034	1	06-10621E21	RESISTOR	215K-1-1/4
R035	1	06-10621C83	RESISTOR	8.25K-1-1/4
R036	1	06-11009C90	RESISTOR	51K-5-1/4
R037	1	06-11009C53	RESISTOR	1.5K-5-1/4
R038	1	06-11009C25	RESISTOR	100-5-1/4
R039	1	06-11009C25	RESISTOR	100-5-1/4

Find No.	Qty. Reg.	Part No.
R040	1	06-11009C84
R041	1	06-11009C77
R042	1	06-11009C33
R043	1	06-11009C07
R044	1	06-11009C32
R045	1	06-11009C36
R046	1	06-11009C25
R047	1	06-10621D51
R048	1	06-10621D51
R049	1	06-10621D51
R050	1	06-10621D51
R051	1	06-10621D21
R052	1	06-10621D21
R053	1	06-11009C03
R054	1	06-11009C46
R055	1	06-10621C63
R056	1	06-10621C92
R057	1	06-10621D10
R058	1	06-10621D73
R059	1	06-10621D80
R060	1	06-10621D57
R061	1	06-11009C46
R062	1	06-10621C71
R063	1	06-11009C90
R064	1	06-11009C53
R065	1	06-11009C53
R066	1	06-11009C53
R067	1	06-11009C29
R068	1	06-11009C39
R080	1	06-11009C22
R071	1	06-11009C50
R072	1	06-11009C54
R073	1	06-11009C55
R074	1	06-11009C31
R075	1	06-11009A20
R076	1	5043CX2R7003
R077	1	06-00124A40
R078	1	06-11009C15
R079	1	06-00124A40
R080	1	06-11009C46
R081	1	06-11009C73
R082	1	06-11009C56
R083	1	06-11009C47
R084	1	06-11009C59
R085	1	06-11009C77
R086	1	06-11009C29
R087	1	06-11009C03
R088	1	06-11009C49
R089	1	06-11009D08
T001	1	25-80342B77
T002	1	25-80342B80
U001	1	51-80345A05
U003	1	51-05596E06
U004	1	51-05698H01
U005	1	51-05698H01
U006	1	51-83625M62
U007	1	51-80365A27
U008	1	51-80339B82
U009	1	51-83625M62
U010	1	51-80340B07
U011	1	51-80372B67
U012	1	51-80339B82
U013	1	51-83627M93
U014	1	51-80372B84
U015	1	51-05469E01
VR001	1	IN752A
VR007	1	48-82256C39
VR008	1	48-83461E32
VR010	1	48-82256C15
VR016	1	48-83461E03
Y001	1	91-80342B86

Nomenclature	Part Value
RESISTOR	4.3K-5-1/4
RESISTOR	15K-5-1/4
RESISTOR	220-5-1/4
RESISTOR	18-5-1/4
RESISTOR	200-5-1/4
RESISTOR	300-5-1/4
RESISTOR	100-5-1/4
RESISTOR	41.2K-1-1/4
RESISTOR	41.2K-1-1/4
RESISTOR	41.2K-1-1/4
RESISTOR	41.2K-1-1/4
RESISTOR	20K-1-1/4
RESISTOR	20K-1-1/4
RESISTOR	12-5-1/4
RESISTOR	750-5-1/4
RESISTOR	5.11K-1-1/4
RESISTOR	10.2K-1-1/4
RESISTOR	15.4K-1-1/4
RESISTOR	69.8K-1-1/4
RESISTOR	82.5K-1-1.4
RESISTOR	47.5K-1-1/4
RESISTOR	750-5-1/4
RESISTOR	6.19K-1-1/4
RESISTOR	51K-5-1/4
RESISTOR	1.5K-5-1/4
RESISTOR	1.5K-5-1/4
RESISTOR	1.5K-5-1/4
RESISTOR	150-5-1/4
RESISTOR	390-5-1/4
RESISTOR	75-5-1/4
RESISTOR	1.1K-5-1/4
RESISTOR	1.6K-5-1/4
RTESISTOR	1.8K-5-1/4
RESISTOR	180-5-1/4
RESISTOR	62-5-1/4
RESISTOR	2.7-5-1/4
RESISTOR	430-5-1/4
RESISTOR	39-5-1/4
RESISTOR	430-5-1/4
RESISTOR	750-5-1/4
RESISTOR	10K-5-1/4
RESISTOR	2K-5-1/4
RESISTOR	820-5-1/4
RESISTOR	2.7K-5-1/4
RESISTOR	15K-5-1/4
RESISTOR	150-5-1/4
RESISTOR	12-5-1/4
RESISTOR	1K-5-1/4
RESISTOR	270K-5-1/4
TRANSFORMER	
TRANSFORMER	
INTEGRATED CIRCUIT	HI-201-5 SCREENED
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	LF356, SCREENED
INTEGRATED CIRCUIT	
INTEGRATED CIRCUIT	
MIXER	
INTEGRATED CIRCUIT	
DIODE, ZENER	5.6V-5-1/2
DIODE, ZENER	20V-5-1/2
DIODE, ZENER	8.2V-5-.5
DIODE, ZENER	5.1V-5-1/4
DIODE, ZENER	3.3V-5-1/4
FILTER	1.05 MHz

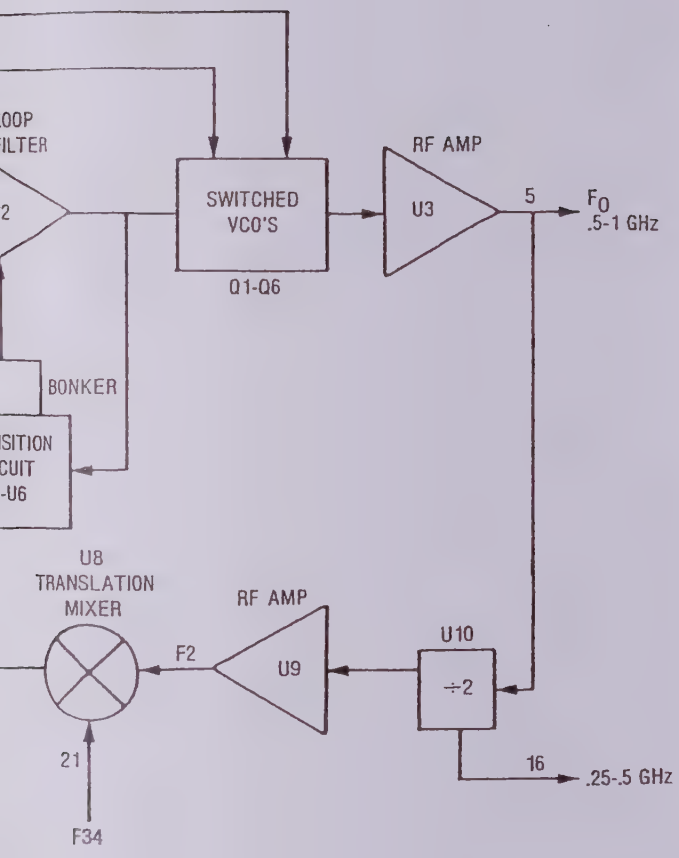

8V 300-350 CLAMP
14
VCO SELECT
26
PHASE DETECTOR U1
90° PHASE SHIFT
SWEEP
GHz LOOP SENSE
25
F60
23
BANDPASS AMPLIFIER
Q7, Q8
U7 LOCK DETECTOR

RF SYNTHESIZER MODULE

GHz LOOP BOARD (A9A5)

(RTC-4043A)

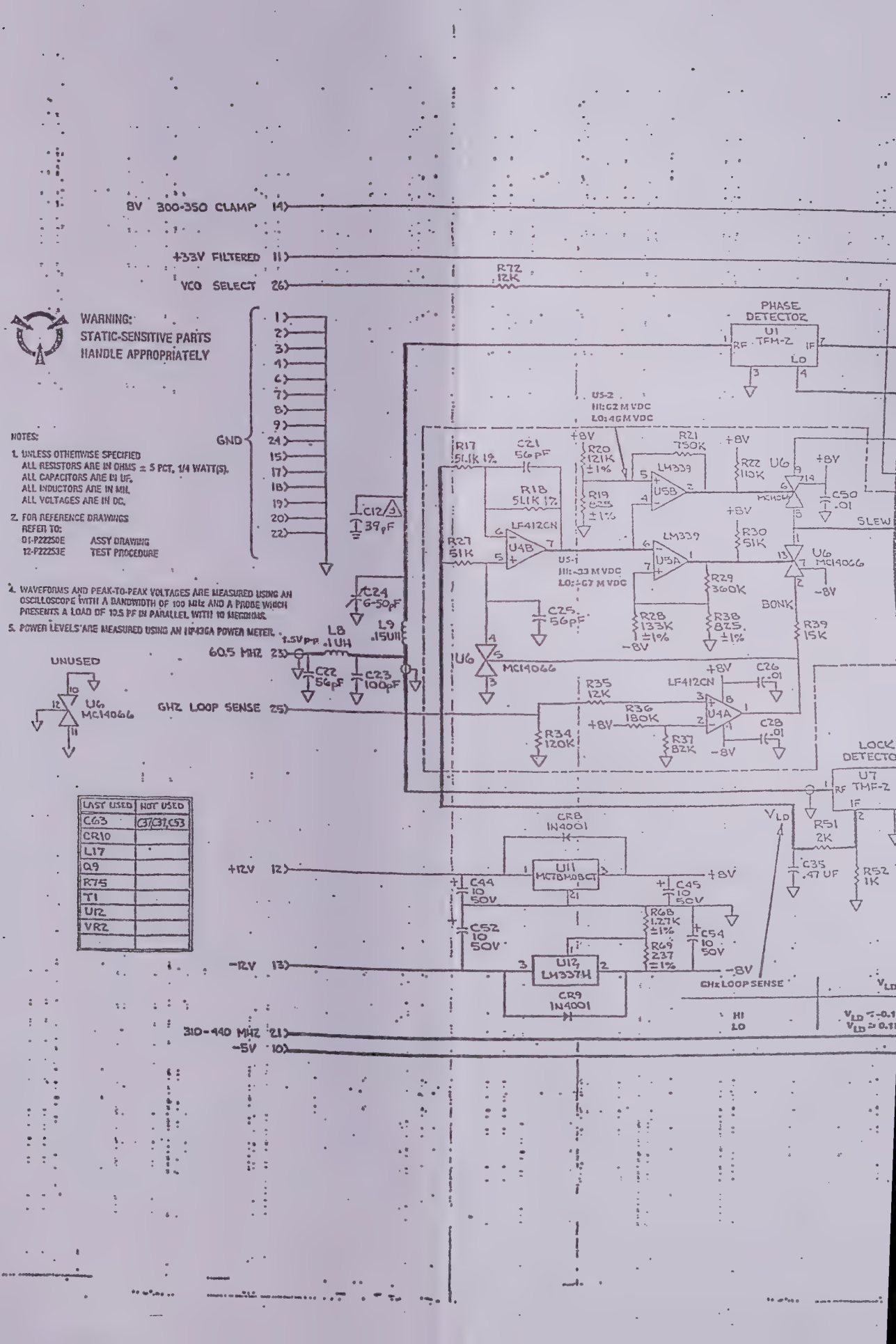
Figure 11-15. Block Diagram

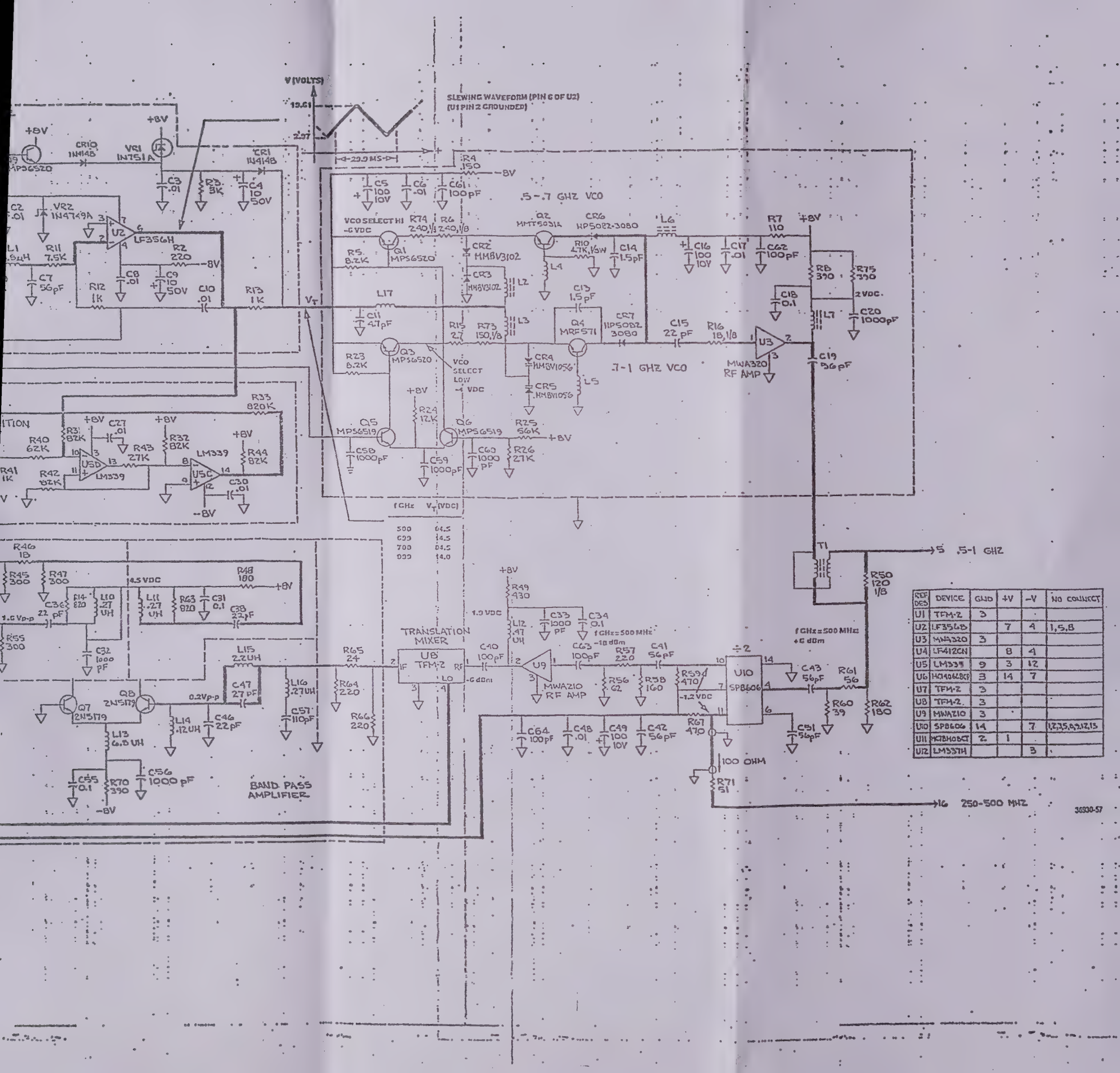


GHz LOOP BOARD (A9A5)

(RTC-4043A)

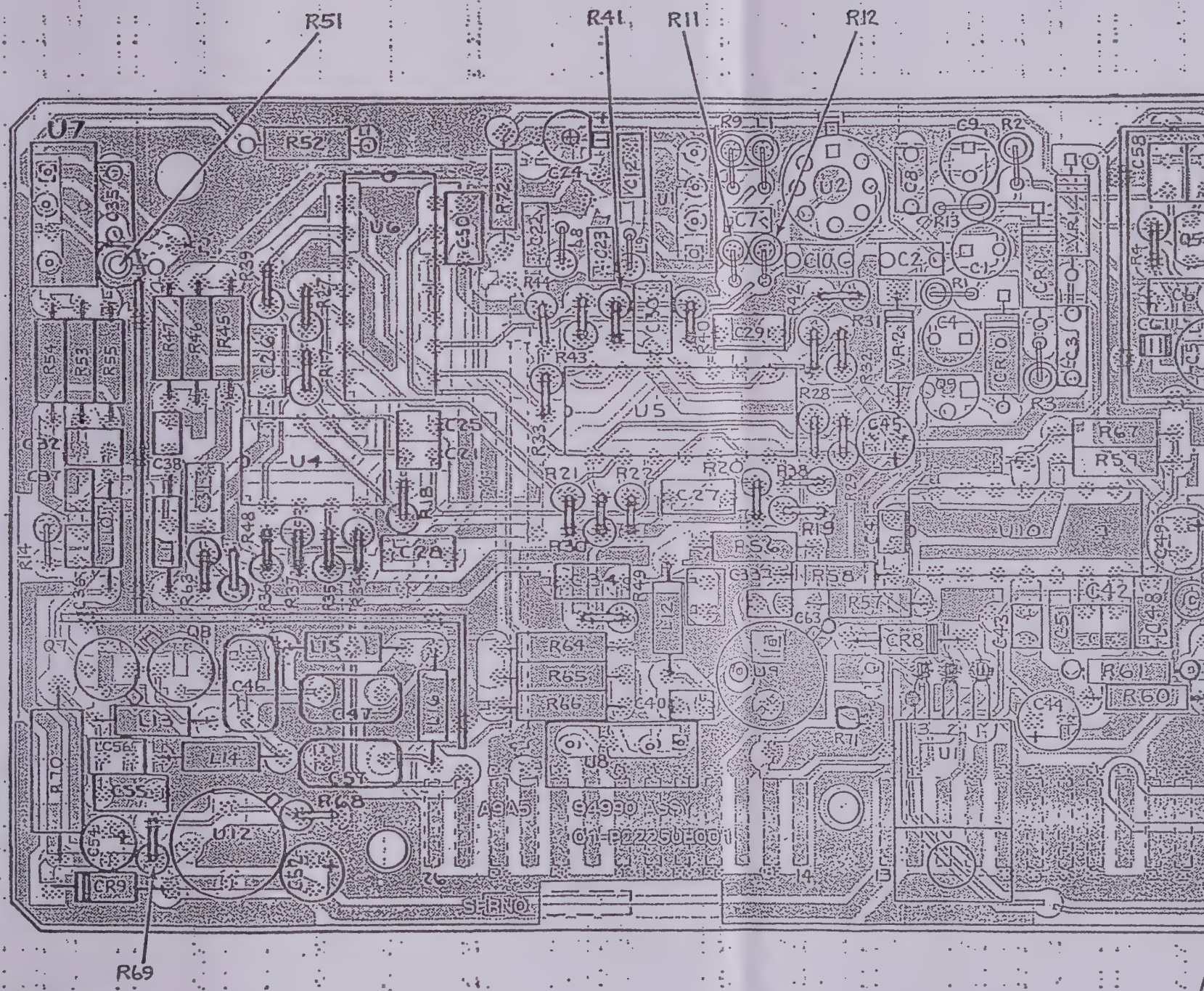
Figure 11-16. Schematic



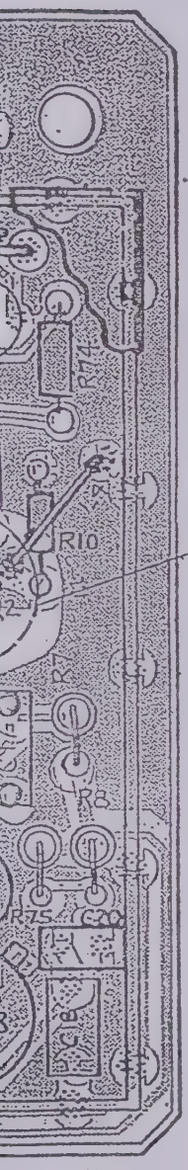


REF DES	DEVICE	GND	+V	-V	NO CONNECT
U1	TFM-2	3			
U2	LF356B		7	4	1,5,8
U3	MWA320	3			
U4	LF412CN		8	4	
U5	LM339	9	3	12	
U6	HC14062BCP	3	14	7	
U7	TFM-2	3			
U8	TFM-2	3			
U9	MWA310	3			
U10	SP8606	14		7	12,13,8,9,12,15
U11	HC18H08CT	2	1		
U12	LM337H			3	

36930-57



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK. SOLDER-SIDE TRACK SHOWN IN ORANGE.



GHz LOOP BOARD (A9A5)
RTC-4043A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
006	1	30-80344B03	CABLE,JUMPER NO.1	
007	1	30-80344B04	CABLE,JUMPER NO.2	
008	1	30-80344B05	CABLE,JUMPER NO.3	
C001	1	23-80341B15	CAPACITOR	10UF-20-50
C002	1	21-80342B09	CAPACITOR	.01UF-20-50
C003	1	21-80342B09	CAPACITOR	.01UF-20-50
C004	1	23-80341B15	CAPACITOR	10UF-20-50
C005	1	23-80341B07	CAPACITOR	100UF-20-10
C006	1	21-80342B09	CAPACITOR	.01UF-20-50
C007	1	21-80339B67	CAPACITOR	56PF-10-200
C008	1	21-80342B09	CAPACITOR	.01UF-20-50
C009	1	23-80341B15	CAPACITOR	10UF-20-50
C010	1	21-80369A99	CAPACITOR	.01UF-10-100
C011	1	21-80370A19	CAPACITOR	4.7PF-.5PF-100
C012	1	21-80372B70	CAPACITOR	39PF-10-200
C012	S01	21-80344B28	CAPACITOR	47PF-5-100
C012	S01	21-80344B30	CAPACITOR	68PF-5-100
C012	S01	21-80344B31	CAPACITOR	82PF-5-100
C013	1	21-80370A09	CAPACITOR	1.5PF-.5PF-100
C014	1	21-80370A09	CAPACITOR	1.5PF-.5PF-100
C015	1	21-80370A14	CAPACITOR	22PF-5-100
C016	1	23-80341B07	CAPACITOR	100UF-20-10
C017	1	21-80342B09	CAPACITOR	.01UF-20-50
C018	1	21-80342B10	CAPACITOR	.1UF-20-50
C019	1	21-80339B67	CAPACITOR	56PF-10-200
C020	1	21-80339B72	CAPACITOR	.001UF-10-200
C021	1	21-80339B67	CAPACITOR	56PF-10-200
C022	1	21-80339B67	CAPACITOR	56PF-10-200
C023	1	21-80339B63	CAPACITOR	100PF-10-200
C024	1	19-80372B83	CAPACITOR	6-50PF VAR
C025	1	21-80339B67	CAPACITOR	56PF-10-200
C026	1	21-80342B09	CAPACITOR	.01UF-20-50
C027	1	21-80342B09	CAPACITOR	.01UF-20-50
C028	1	21-80342B09	CAPACITOR	.01UF-20-50
C029	1	21-80342B10	CAPACITOR	.1UF-20-50
C030	1	21-80342B09	CAPACITOR	.01UF-20-50
C031	1	21-80342B10	CAPACITOR	.1UF-20-50
C032	1	21-80339B72	CAPACITOR	.001UF-10-200
C033	1	21-80339B72	CAPACITOR	.001UF-10-200
C034	1	21-80342B10	CAPACITOR	.1UF-20-50
C035	1	21-80372B65	CAPACITOR	.47UF-10-100
C036	1	21-80344B32	CAPACITOR	22PF-5-200
C037	1	21-80339B68	CAPACITOR	68PF-10-200
C038	1	21-80344B32	CAPACITOR	22PF-5-200
C039	1	21-80339B68	CAPACITOR	68PF-10-200
C040	1	21-80339B63	CAPACITOR	100PF-10-200
C041	1	21-80339B67	CAPACITOR	56PF-10-200
C042	1	21-80339B67	CAPACITOR	56PF-10-200
C043	1	21-80339B67	CAPACITOR	56PF-10-200
C044	1	23-80341B15	CAPACITOR	10UF-20-50
C045	1	23-80341B15	CAPACITOR	10UF-20-50
C046	1	21-80369A86	CAPACITOR	22PF-5-500
C047	1	21-80369A89	CAPACITOR	27PF-5-500
C048	1	21-80342B09	CAPACITOR	.01UF-20-50
C049	1	23-80341B07	CAPACITOR	100UF-20-10
C050	1	21-80342B09	CAPACITOR	.01UF-20-50
C051	1	21-80339B67	CAPACITOR	56PF-10-200
C052	1	23-80341B15	CAPACITOR	10UF-20-50
C054	1	23-80341B15	CAPACITOR	10UF-20-50
C055	1	21-80342B10	CAPACITOR	.1UF-20-50
C056	1	21-80339B72	CAPACITOR	.001UF-10-200
C057	1	21-80339B24	CAPACITOR	110PF-5-500
C058	1	21-80339B72	CAPACITOR	.001UF-10-200
C059	1	21-80339B72	CAPACITOR	.001UF-10-200
C060	1	21-80339B72	CAPACITOR	.001UF-10-200
C061	1	21-80370A21	CAPACITOR	100PF-20-100
C062	1	21-80370A21	CAPACITOR	100PF-20-100
C063	1	21-80339B63	CAPACITOR	100PF-10-200
C064	1	21-80370A21	CAPACITOR	100PF-20-100
CR001	1	48-84463K02	DIODE	
CR002	1	48-80372B76	DIODE	
CR003	1	48-80372B76	DIODE	
CR004	1	48-80372B77	DIODE	
CR005	1	48-80372B77	DIODE	
CR006	1	48-80339B87	DIODE	
CR007	1	48-80339B87	DIODE	
CR008	1	48-82466H13	DIODE	
CR009	1	48-82466H13	DIODE	
CR010	1	48-84463K02	DIODE	
L001	1	24-80369A28	COIL	6.8UH
L002	1	24-83961B01	CHOKE	
L003	1	24-83961B01	CHOKE	
L004	1	24-80342B73	COIL	
L005	1	24-80342B72	COIL	

RF SYNTHESIZER MODULE
GHz LOOP BOARD (A9A5)
(RTC-4043A)

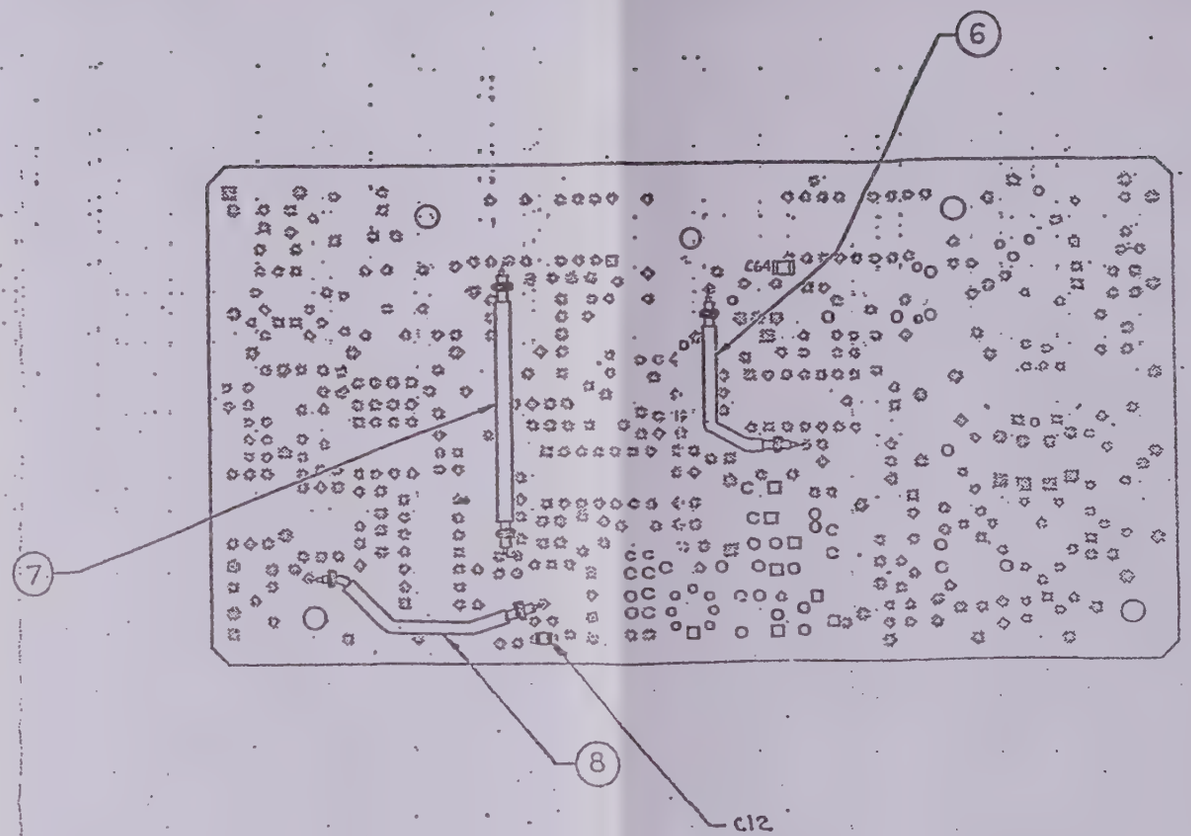
Figure 11-17a: Printed Wiring Board Assembly and Parts List

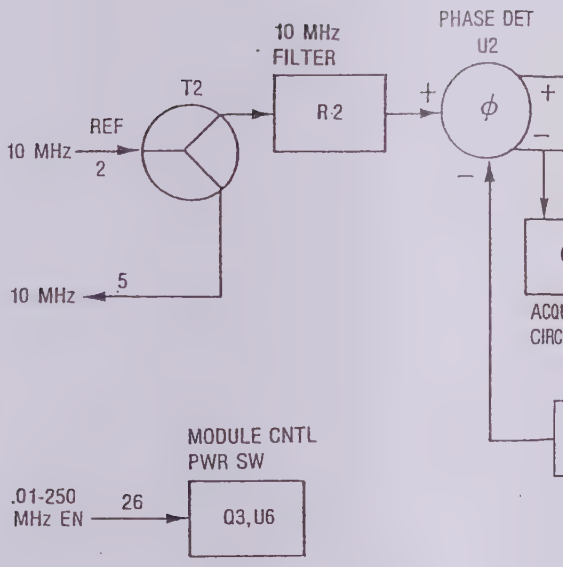
Figure 11-17b. Printed Wiring Board Assembly and Parts List

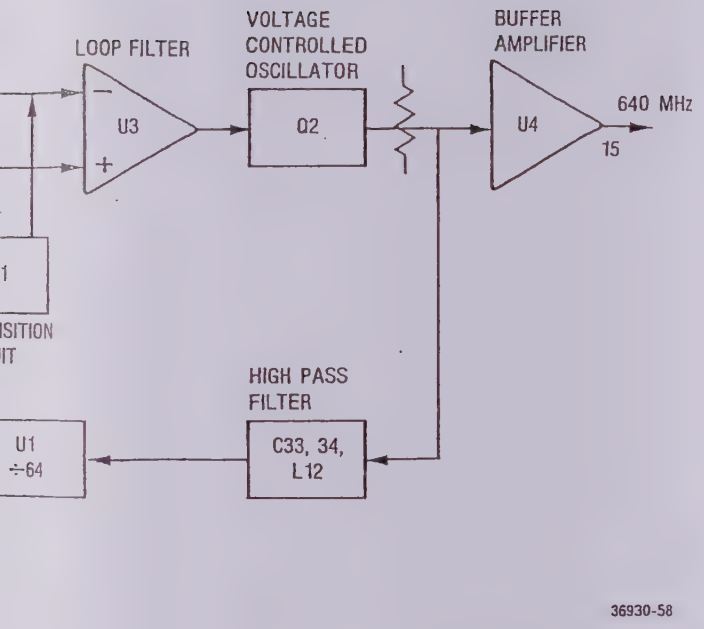
Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
L006	1	24-83961B01	CHOKE	
L007	1	24-83961B01	CHOKE	
L008	1	24-80369A19	COIL	.1UH
L009	1	24-80369A23	COIL	.15UH
L010	1	24-80340B51	COIL	.27UH
L011	1	24-80340B51	COIL	.27UH
L012	1	24-80369A27	COIL	.47UH
L013	1	24-80369A28	COIL	6.8UH
L014	1	24-80340B50	COIL	.12UH
L015	1	24-80369A32	COIL	2.2UH
L016	1	24-80340B51	COIL	.27UH
L017	1	24-83961B01	CHOKE	
Q001	1	48-80340B86	TRANSISTOR	MPS6520
Q002	1	48-80372B75	TRANSISTOR	
Q003	1	48-80340B86	TRANSISTOR	MPS6520
Q004	1	48-80340B48	TRANSISTOR	
Q005	1	48-80340B85	TRANSISTOR	MPS6519
Q006	1	48-80340B85	TRANSISTOR	MPS6519
Q007	1	48-00869776	TRANSISTOR	
Q008	1	48-00869776	TRANSISTOR	
Q009	1	48-80340B86	TRANSISTOR	MPS6520
R001	1	06-11009C52	RESISTOR	1.3K-5-1/4
R002	1	06-11009C33	RESISTOR	220-5-1/4
R003	1	06-11009C60	RESISTOR	3K-5-1/4
R004	1	06-11009C29	RESISTOR	150-5-1/4
R005	1	06-11009C71	RESISTOR	8.2K-5-1/4
R006	1	06-11041C50	RESISTOR	240-5-1/8
R007	1	06-11009C26	RESISTOR	110-5-1/4
R008	1	06-11009C39	RESISTOR	390-5-1/4
R009	1	06-11009C49	RESISTOR	1K-5-1/4
R010	1	06-00185A65	RESISTOR	4.7K-5-1/8
R011	1	06-11009C70	RESISTOR	7.5K-5-1/4
R012	1	06-00124A49	RESISTOR	1K-5-1/4
R013	1	06-11009C49	RESISTOR	1K-5-1/4
R014	1	06-0012A47	RESISTOR	820-5-1/4
R015	1	06-11041A03	RESISTOR	2.7-5-1/8
R016	1	06-11041A23	RESISTOR	18-5-1/8
R017	1	06-10621D60	RESISTOR	51.1K-1-1/4
R018	1	06-10621D60	RESISTOR	51.1K-1-1/4
R019	1	06-10621B86	RESISTOR	825-1-1/4
R020	1	06-10621C99	RESISTOR	121K-1-1/4
R021	1	06-11009D19	RESISTOR	750K-5-1/4
R022	1	06-11009C98	RESISTOR	110K-5-1/4
R023	1	06-11009C71	RESISTOR	8.2K-5-1/4
R024	1	06-11009C75	RESISTOR	12K-5-1/4
R025	1	06-11009C91	RESISTOR	56K-5-1/4
R026	1	06-11009C83	RESISTOR	27K-5-1/4
R027	1	06-11009C90	RESISTOR	51K-5-1/4
R028	1	06-10621E01	RESISTOR	133K-1-1/4
R029	1	06-11009D11	RESISTOR	360K-5-1/4
R030	1	06-11009C90	RESISTOR	51K-5-1/4
R031	1	06-11009C95	RESISTOR	82K-5-1/4
R032	1	06-11009C95	RESISTOR	82K-5-1/4
R033	1	06-11009D20	RESISTOR	820K-5-1/4
R034	1	06-11009C99	RESISTOR	120K-5-1/4
R035	1	06-11009C75	RESISTOR	12K-5-1/4
R036	1	06-11009D04	RESISTOR	180K-5-1/4
R037	1	06-11009C95	RESISTOR	82K-5-1/4
R038	1	06-10621B86	RESISTOR	825-1-1/4
R039	1	06-11009C77	RESISTOR	15K-5-1/4
R040	1	06-11009C92	RESISTOR	62K-5-1/4
R041	1	06-11009C49	RESISTOR	1K-5-1/4
R042	1	06-11009C95	RESISTOR	82K-5-1/4
R043	1	06-11009C83	RESISTOR	27K-5-1/4
R044	1	06-11009C95	RESISTOR	82K-5-1/4
R045	1	06-11009C36	RESISTOR	300-5-1/4
R046	1	06-11009C07	RESISTOR	18-5-1/4
R047	1	06-11009C36	RESISTOR	300-5-1/4
R048	1	06-11009C31	RESISTOR	180-5-1/4
R049	1	06-11009C40	RESISTOR	430-5-1/4
R050	1	06-11041C43	RESISTOR	120-5-1/8
R051	1	06-11009C56	RESISTOR	2K-5-1/4
R052	1	06-11009C49	RESISTOR	1K-5-1/4
R053	1	06-11009C36	RESISTOR	300-5-1/4
R054	1	06-11009C07	RESISTOR	18-5-1/4
R055	1	06-11009C36	RESISTOR	300-5-1/4
R056	1	06-00124A20	RESISTOR	62-5-1/4
R057	1	06-00124A33	RESISTOR	220-5-1/4
R058	1	06-00124A30	RESISTOR	160-5-1/4
R059	1	06-11009C41	RESISTOR	470-5-1/4
R060	1	06-11009C15	RESISTOR	39-5-1/4

Find No.	Qty. Req.	Part
R061	1	06-11
R062	1	06-11
R063	1	06-00
R064	1	06-00
R065	1	06-00
R066	1	06-00
R067	1	06-11
R068	1	06-10
R069	1	06-10
R070	1	06-11
R071	1	06-80
R072	1	06-11
R073	1	06-00
R074	1	06-11
R075	1	06-11
T001	1	25-80
001	1	74-15
U001	1	51-80
U002	1	51-80
U003	1	51-80
U004	1	51-80
U005	1	51-83
U006	1	51-82
U007	1	51-80
U008	1	51-80
U009	1	51-80
U010	1	51-80
U011	1	51-05
U012	1	51-80
VR001	1	48-82
VR002	1	RG-1
T001		
001	1	74-15

Part Value
56-5-1/4
180-5-1/4
820-5-1/4
220-5-1/4
24-5-1/4
220-5-1/4
470-5-1/4
1.27K-1-1/4
237-1-1/4
390-5-1/2
50-5-.1
12K-5-1/4
150-5-1/8
240-5-1/8
390-5-1/4
2T #32 ON 3B BEAD
5.1V-5-.5
24V-5-1




10 MHz
FILTER
PHASE DET
U2
T2
REF
10 MHz
2
R2
+
ϕ
+
−
−
10 MHz
5
MODULE CNTL
PWR SW
.01-250
MHz EN
26
Q3,U6



RF SYNTHESIZER MODULE

640-MHz LOOP BOARD (A9A6)

(RTC-4044A)

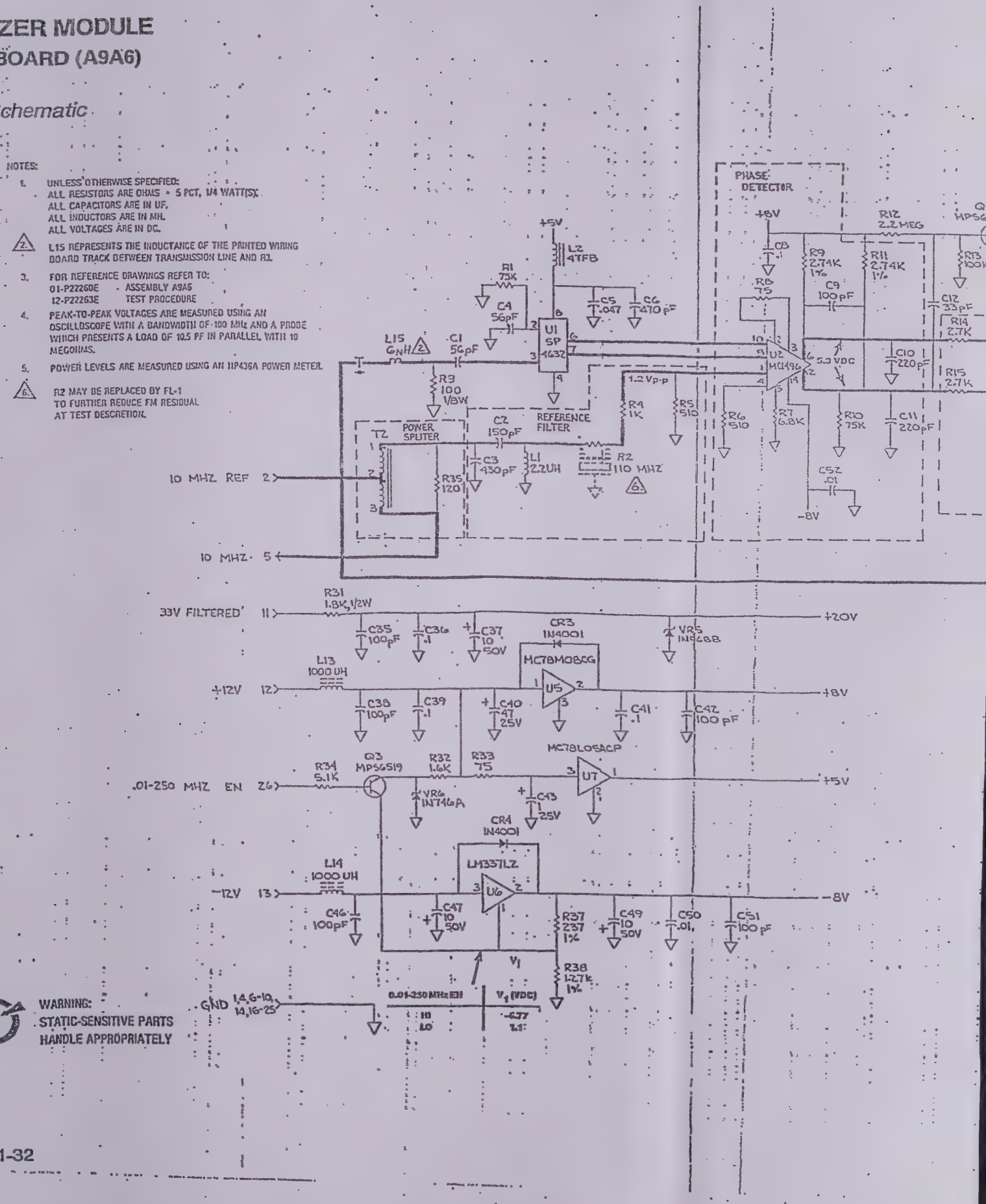
Figure 11-18. Block Diagram

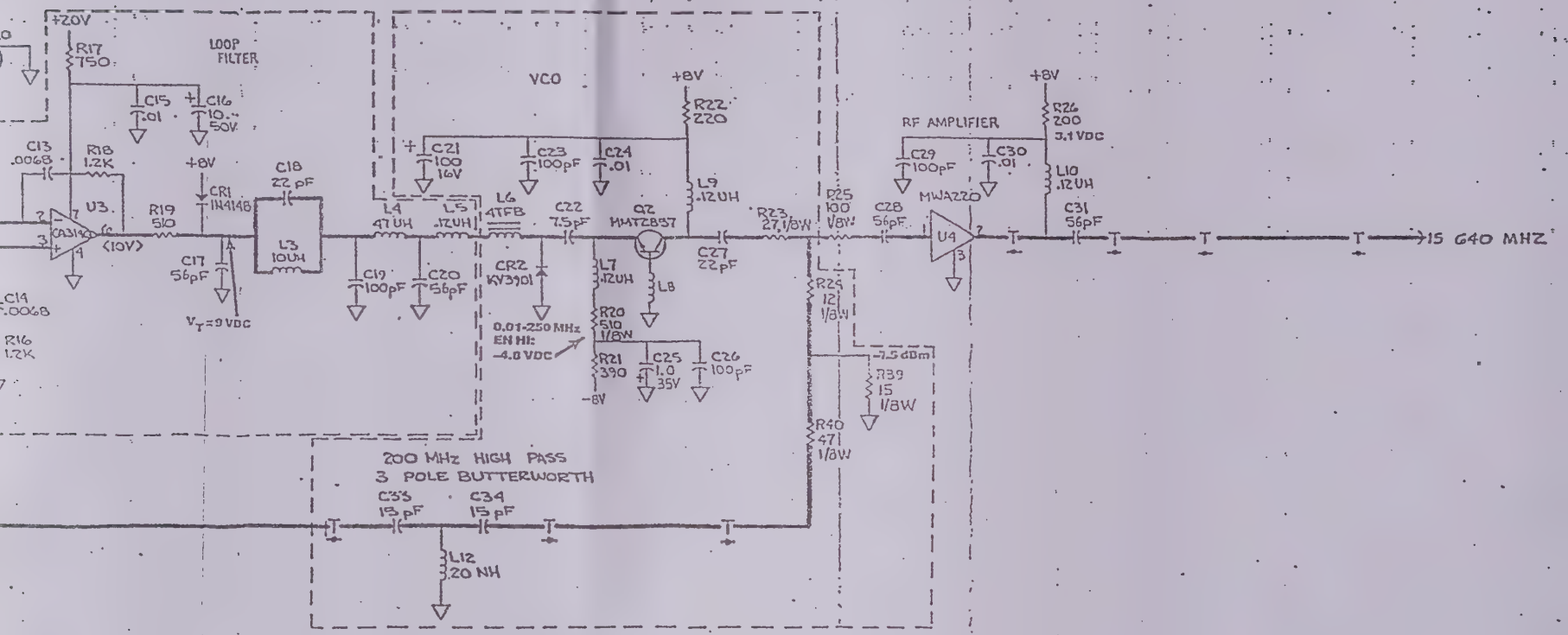
RF SYNTHESIZER MODULE

640-MHz LOOP BOARD (A9A6)

(RTC-4044A)

Figure 11-19. Schematic





LAST USED	NOT USED
C52	C7, C32, C45, C48, C46
CR4	
L15	L11
Q3	
R40	R2 R27 THRU R30
	R36
T2	T1
U7	
VR6	VR1 THRU VR4

REF DES	DEVICE	+V	-V	GND	NO CONNECT
U1	SP4632	8		4	1,5
U2	MC1496P		14		7,9,11,13
U3	CA3140E	7		4	1,5,8
U4	MWA220H			3	
U5	MC78M08CG	1		3	
U6	LM337LZ		3		
U7	MC78L05ACP	3		2	

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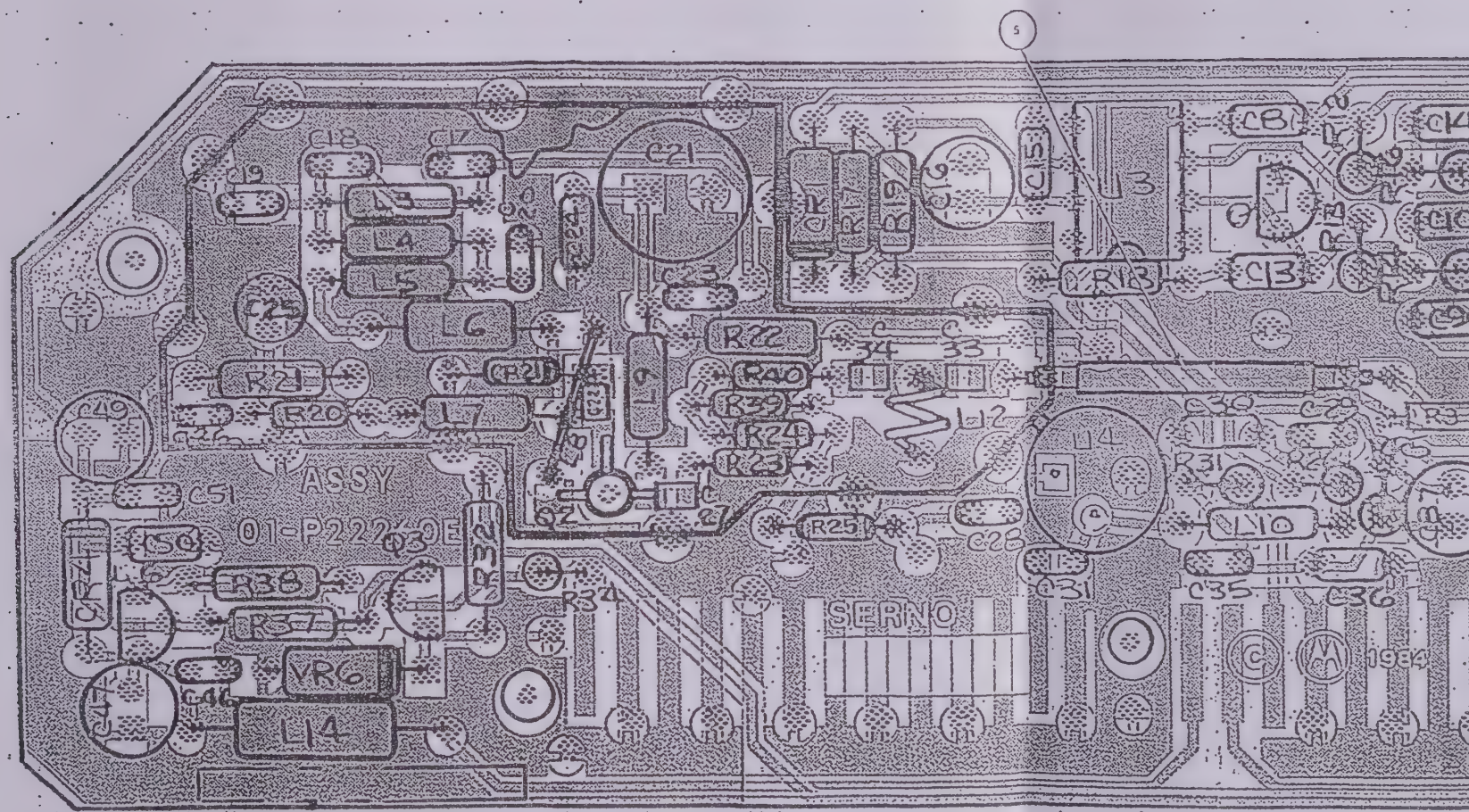
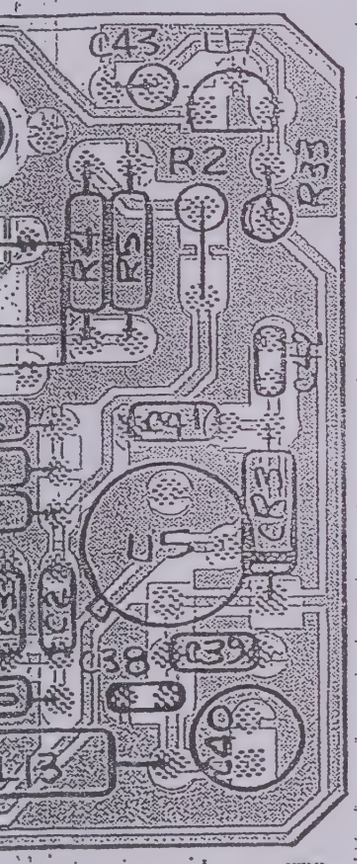
640-MHz LOOP BOARD (A9A6) (Cont)
RTC-4044A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 016	1	06-11009C51	RESISTOR	1.2K-5-1/4
R 017	1	06-11009C46	RESISTOR	750-5-1/4
R 018	1	06-11009C51	RESISTOR	1.2K-5-1/4
R 019	1	06-11009C42	RESISTOR	510-5-1/4
R 020	1	06-11041C58	RESISTOR	510-5-1/8
R 021	1	06-11009C39	RESISTORS	390-5-1/4
R 022	1	06-11009C33	RESISTOR	220-5-1/4
R 023	1	06-11041C27	RESISTOR	27-5-1/8
R 024	1	06-11041A19	RESISTOR	12-5-1/8
R 025	1	06-11041C41	RESISTOR	100-5-1/8
R 026	1	06-11009C32	RESISTOR	200-5-1/4
R 031	1	06-11045A55	RESISTOR	1.8K-5-1/2
R 032	1	06-11009C54	RESISTOR	1.6K-5-1/4
R 033	1	06-11009C22	RESISTOR	75-5-1/4
R 034	1	06-11009C66	RESISTOR	5.1K-5-1/4
R 035	1	06-11009C27	RESISTOR	120-5-1/4
R 037	1	06-10621B34	RESISTOR	237-1-1/4
R 038	1	06-10621C05	RESISTOR	1.27K-1-1/4
R 039	1	06-11041A21	RESISTOR	15-5-1/8
R 040	1	06-11041A33	RESISTOR	47-5-1/8
T 002	1	25-80342B75	TRANSFORMER	
U 001	1	51-80340B89	INTEGRATED CIRCUIT	
U 002	1	51-83222M02	INTEGRATED CIRCUIT	
U 003	1	51-80345A01	INTEGRATED CIRCUIT	CA3140E SCREENED
U 004	1	51-80340B62	INTEGRATED CIRCUIT	
U 005	1	51-05698H01	INTEGRATED CIRCUIT	
U 006	1	51-80340B05	INTEGRATED CIRCUIT	
U 007	1	51-05469E01	INTEGRATED CIRCUIT	
VR005	1	48-82256C39	DIODE,ZENER	20V-5-1/2
VR006	1	48-83461E03	DIODE,ZENER	3.3V-5-.5



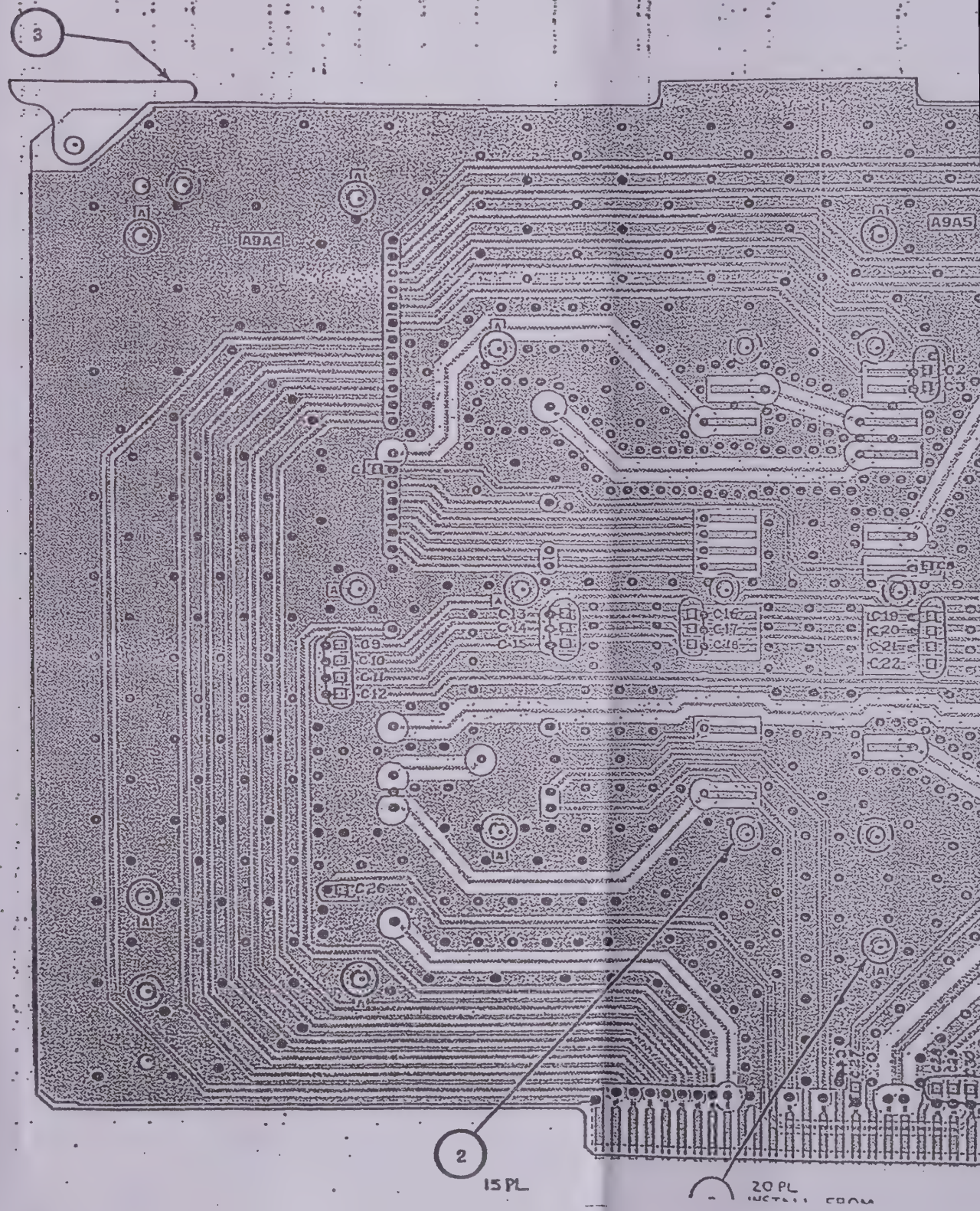
COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE

Figure 11-20. Printed Wiring Board Assembly and Parts List



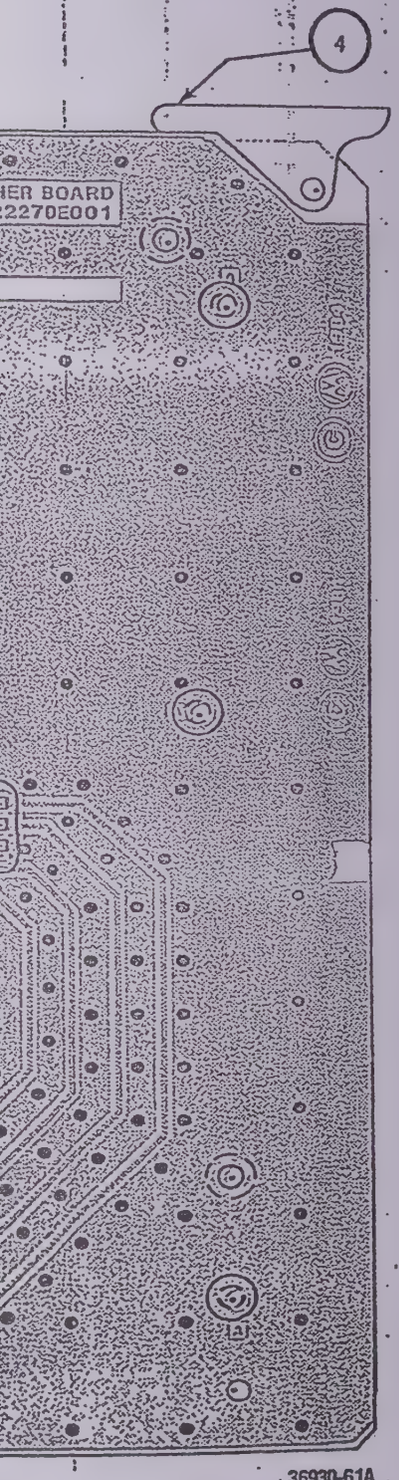
640-MHz LOOP BOARD (A9A6)
RTC-4044A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
005	1	30-80343B95	JUMPER,COAX	
C001	1	21-80339B57	CAPACITOR	56PF-10-200
C002	1	21-80341B54	CAPACITOR	150PF-5-50
C003	1	21-80341B80	CAPACITOR	430PF-5-50
C004	1	21-80339B57	CAPACITOR	56PF-10-200
C005	1	21-80342B13	CAPACITOR	.047UF-20-50
C006	1	21-80339B79	CAPACITOR	470PF-10-200
C008	1	21-80342B10	CAPACITOR	.1UF-20-50
C009	1	21-80341B45	CAPACITOR	100PF-5-50
C010	1	21-80341B60	CAPACITOR	220PF-5-50
C011	1	21-80341B60	CAPACITOR	220PF-5-50
C012	1	21-80341B68	CAPACITOR	33PF-5-50
C013	1	21-80342B08	CAPACITOR	.0068UF-10-100
C014	1	21-80342B08	CAPACITOR	.0068UF-10-100
C015	1	21-80342B09	CAPACITOR	.01UF-20-50
C016	1	23-80341B15	CAPACITOR	10UF-20-50
C017	1	21-80339B57	CAPACITOR	56PF-10-200
C018	1	21-80344B32	CAPACITOR	22PF-10-100
C019	1	21-80339B63	CAPACITOR	100PF-10-200
C020	1	21-80339B57	CAPACITOR	56PF-10-200
C021	1	23-84665F26	CAPACITOR	100UF-20-15
C022	1	21-80344B44	CAPACITOR	7.5PF-.5-100
C023	1	21-80339B63	CAPACITOR	100PF-10-200
C024	1	21-80342B09	CAPACITOR	.01UF-20-50
C025	1	23-83441B15	CAPACITOR	1.0UF-20-35
C026	1	21-80339B63	CAPACITOR	100PF-10-200
C027	1	21-80370A14	CAPACITOR	22PF-5-100
C028	1	21-80339B57	CAPACITOR	56PF-10-200
C029	1	21-80339B63	CAPACITOR	100PF-10-200
C030	1	21-80342B09	CAPACITOR	.01UF-20-50
C031	1	21-80339B57	CAPACITOR	56PF-10-200
C033	1	21-80370A12	CAPACITOR	15PF-5-100
C034	1	21-80370A12	CAPACITOR	15PF-5-100
C035	1	21-80339B63	CAPACITOR	100PF-10-200
C036	1	21-80342B10	CAPACITOR	.1UF-10-50
C037	1	23-80341B15	CAPACITOR	10UF-20-50
C038	1	21-80339B63	CAPACITOR	100PF-10-200
C039	1	21-80342B10	CAPACITOR	.1UF-20-50
C040	1	23-80341B13	CAPACITOR	47UF-20-25
C041	1	21-80342B10	CAPACITOR	.1UF-20-50
C042	1	21-80339B63	CAPACITOR	100PF-10-200
C043	1	23-80340B96	CAPACITOR	1.0UF-20-25
C045	1	21-80339B63	CAPACITOR	100PF-10-200
C047	1	23-80341B15	CAPACITOR	10UF-20-50
C049	1	23-80341B15	CAPACITOR	10UF-20-50
C050	1	21-80342B09	CAPACITOR	.01UF-20-50
C051	1	21-80339B63	CAPACITOR	100PF-10-200
C052	1	21-80342B09	CAPACITOR	.01UF-20-50
CR001	1	48-84463K02	DIODE	
CR002	1	48-80339B95	DIODE	
CR003	1	48-82466H13	DIODE	
CR004	1	48-82466H13	DIODE	
FL001	1	48-80346A08	CRYSTAL FILTER	10MHZ-2-POLE
*L001	1	24-80359A32	COIL	2.2UH
L002	1	24-83961B01	CHOKE	
L003	1	24-80359A29	COIL	10UH
L004	1	24-80359A33	COIL	47UH
L005	1	24-80340B50	COIL	.12UH
L006	1	24-83961B01	CHOKE	
L007	1	24-80340B50	COIL	.12UH
L008	1	24-80342B71	COIL	
L009	1	24-80340B50	COIL	.12UH
L010	1	24-80340B50	COIL	.12UH
L012	1	24-80342B66	COIL	
L013	1	24-80359A42	COIL	1000UH
L014	1	24-80359A42	COIL	1000UH
Q001	1	48-80340B86	TRANSISTOR	MPS6520
Q002	1	48-00869824	TRANSISTOR	
Q003	1	48-80340B85	TRANSISTOR	MPS6519
* R002	1	5043C**1K0005	RESISTOR	1K-5-1/4
R003	1	06-11041C41	RESISTOR	100-5-1/8
R004	1	06-11009C49	RESISTOR	1K-5-1/4
R005	1	06-11009C42	RESISTOR	510-5-1/4
R006	1	06-11009C42	RESISTOR	510-5-1/4
R007	1	06-11009C69	RESISTOR	6.8K-5-1/4
R008	1	06-11009C22	RESISTOR	75-5-1/4
R009	1	06-10621C37	RESISTOR	2.74K-1-1/4
R010	1	06-11009C94	RESISTOR	75K-5-1/4
R011	1	06-10621C37	RESISTOR	2.74K-1-1/4
R012	1	06-80344B24	RESISTOR	2.2M-5-1/4
R013	1	06-11009C97	RESISTOR	100K-5-1/4
R014	1	06-11009C59	RESISTOR	2.7K-5-1/4
R015	1	06-11009C59	RESISTOR	2.7K-5-1/4



COMPONENTS AND FRONT SIDE OF BOARD SHOWN IN BLACK.
INNER LAYER OF BOARD SHOWN IN ORANGE.

135



SYNTHESIZER MOTHERBOARD (A9A7)
RTC-4045A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
C001	1	21-80342B42	CAPACITOR	.22-10-100
C002	1	23-80340B33	CAPACITOR	47UF-10-20
C003	1	23-80340B33	CAPACITOR	47UF-10-20
C004	1	21-80342B10	CAPACITOR	.1UF-20-50
C006	1	21-80342B10	CAPACITOR	.1UF-20-50
C007	1	21-80341B92	CAPACITOR	1000PF-10-100
C008	1	21-80342B10	CAPACITOR	.1UF-20-50
C009	1	21-80342B10	CAPACITOR	.1UF-20-50
C010	1	23-80341B13	CAPACITOR	47UF-20-25
C011	1	23-80340B96	CAPACITOR	1.0UF-20-25
C012	1	23-80340B36	CAPACITOR	22UF-10-15
C013	1	23-80341B15	CAPACITOR	10UF-20-50
C014	1	21-80342B10	CAPACITOR	.1UF-20-50
C015	1	21-80342B10	CAPACITOR	.1UF-20-50
C016	1	21-80342B06	CAPACITOR	4700PF-20-100
C017	1	21-80342B06	CAPACITOR	4700PF-20-100
C018	1	21-80342B10	CAPACITOR	.1UF-20-50
C019	1	23-80341B15	CAPACITOR	10UF-20-50
C020	1	23-80341B11	CAPACITOR	47UF-20-16
C021	1	21-80342B10	CAPACITOR	.1UF-20-50
C022	1	21-80342B10	CAPACITOR	.1UF-20-50
C023	1	21-80341B46	CAPACITOR	1000PF-5-50
C024	1	21-80341B93	CAPACITOR	1000PF-20-100
C025	1	21-80342B09	CAPACITOR	.01UF-20-50
C026	1	21-80342B10	CAPACITOR	.1UF-20-50
C027	1	21-80342B06	CAPACITOR	4700PF-20-100
C028	1	21-80341B93	CAPACITOR	1000PF-20-100
C029	1	21-80341B93	CAPACITOR	1000PF-20-100
C030	1	08-80343B12	CAPACITOR	1UF-10-100
C031	1	21-80341B94	CAPACITOR	.01UF-20-100
C032	1	08-80343B12	CAPACITOR	.1UF-10-100
C033	1	21-80341B70	CAPACITOR	330PF-10-50
C034	1	08-80343B12	CAPACITOR	.1UF-10-100
C035	1	21-80341B93	CAPACITOR	1000PF-20-100
C036	1	08-80343B12	CAPACITOR	.1UF-10-100
C037	1	21-80341B70	CAPACITOR	330PF-10-50
C038	1	23-80341B15	CAPACITOR	10UF-20-50
C039	1	21-80342B10	CAPACITOR	.1UF-20-50
C040	1	21-80341B04	CAPACITOR	.01UF-10-100
C042	1	21-80339B12	CAPACITOR	12PF-5-500
C043	1	21-80341B84	CAPACITOR	.0047UF-10-030
C044	1	21-80342B10	CAPACITOR	.1UF-20-50
C045	1	23-80341B07	CAPACITOR	100UF-20-10
C046	1	20-80343B36	CAPACITOR	2.5 TO 11PF-350-NPO
C047	1	21-00859934	CAPACITOR	10PF-.5PF-500
C048	1	21-80339B25	CAPACITOR	120PF-5-500
C049	1	21-80339B62	CAPACITOR	5.6PF-10-200
C050	1	21-80342B10	CAPACITOR	.1UF-20-50
C051	1	21-80342B06	CAPACITOR	4700PF-20-100
C052	1	21-80339B66	CAPACITOR	390PF-5-100
C055	1	23-80341B15	CAPACITOR	10UF-20-50
C056	1	21-80342B10	CAPACITOR	.1UF-20-50
C057	1	21-80342B39	CAPACITOR	.022UF-5-50
C058	1	21-80342B39	CAPACITOR	.022UF-5-50
C059	1	21-80341B79	CAPACITOR	390PF-10-50
C060	1	21-80341B93	CAPACITOR	1000PF-20-100
C061	1	08-80343B16	CAPACITOR	2.2UF-5-100
C062	1	08-80343B16	CAPACITOR	2.2UF-5-100
C063	1	21-80342B10	CAPACITOR	.1UF-20-50
C064	1	23-80341B15	CAPACITOR	10UF-20-50
C065	1	08-80343B12	CAPACITOR	.1UF-10-100
C066	1	21-80342B34	CAPACITOR	.015UF-5-50
C067	1	21-80341B73	CAPACITOR	3600PF-5-50
C068	1	21-80341B73	CAPACITOR	3600PF-5-50
C069	1	21-80342B39	CAPACITOR	.022UF-5-50
C070	1	21-80342B10	CAPACITOR	.1UF-20-50
C071	1	23-80341B15	CAPACITOR	10UF-20-50
C073	1	23-80341B01	CAPACITOR	.47UF-5-25
C074	1	21-80342B09	CAPACITOR	.01UF-20-50
C075	1	21-80341B46	CAPACITOR	1000PF-5-50
C076	1	21-80341B46	CAPACITOR	1000PF-5-50
C077	1	21-80341B46	CAPACITOR	1000PF-5-50
C079	1	23-80340B32	CAPACITOR	100UF-10-20
C080	1	21-80339B69	CAPACITOR	680PF-10-100
C081	1	21-80339B69	CAPACITOR	680PF-10-100
C082	1	21-80339B50	CAPACITOR	10PF-10-200
C083	1	21-80339B61	CAPACITOR	220PF-10-100
C084	1	21-80342B10	CAPACITOR	.1UF-20-50
C085	1	21-80341B93	CAPACITOR	1000PF-20-100

SYNTHESIZER MOTHERBOARD (A9A7)
(RTC-4045A)

Figure 11-21a. Printed Wiring Board Assembly and Parts List (Sheet 1 of 2)

SECTION 12.
AUDIO SYNTHESIZER BOARD (A10)

12.1 DESCRIPTION

The Audio Synthesizer board generates and processes baseband signals, providing the composite modulating signal for RF-signal generation. The A10 board consists of an Audio Synthesizer that generates frequencies in the range of 5 to 19999.9 Hz, a digital private line (DPL) generator, and a fixed 1-kHz source. The A10 board provides external microphone and external audio inputs, and sums all modulation sources to form the composite modulation source.

A block diagram of the Audio Synthesizer board is shown at the end of this section in Figure 12-1, a schematic in Figure 12-2, and the printed wiring board assembly and parts list in Figure 12-3.

12.2 THEORY OF OPERATION

12.2.1 AUDIO SYNTHESIZER

12.2.1.1 General

Audio frequencies from 5 to 19999.9 Hz, in increments of 0.1 Hz, are synthesized using a phase-accumulative technique. Consider the 360 degrees in a cycle to be divided into 2^{20} pieces. A 20-bit digital accumulator, incrementing at some fixed rate, could then at any instant represent a fixed point in the 360-degree cycle. That is, if the accumulator were half full, it would represent the 180-degree point, and if totally full, would represent the 360-degree point. The number of times per second that the accumulator goes through a complete cycle determines the output frequency. If the increment rate is fixed, the time required to accumulate 2^{20} bits can be varied by changing the number of bits added at each time increment.

12.2.1.2 Clock Generator

The 104.8576-kHz clock generator (U6 and U7) provides the increment rate for the Audio Synthesizer. If only one bit were added each time, the time to complete one cycle would be 10 seconds. Processor-loaded control latches U40-U44 determine the number of bits to be added at each time increment and, thus, the final output frequency. A 20-bit adder (U26-U30) adds the control word to the current word in the 20-bit accumulator latch (U14-U18). At the next time increment, the adder output is latched, becoming the next input to the adder.

12.2.1.3 Digital-To-Analog Conversion

The linear digital output of the 20-bit latch accumulator is converted into a sinusoidal digital output by the decode EPROM (U11). Following the decode EPROM is a digital-to-analog converter (U3) which converts the sinusoidal information into a quantized sinewave with a period equal to the cycle time of the 20-bit accumulator latch.

12.2.1.4 Bandpass Filter

Bandpass filter U1 and U2, with a passband of 5 to 10 kHz, filters the quantized waveform to a sinewave having less than 1 percent distortion. The level of the sinewave is processor-controllable by a programmable attenuator (U23C and U23D) having dB settings of 0, 10, and 30.

12.2.2 DPL GENERATOR

12.2.2.1 General

The 23-bit digital private line (DPL) word is generated by the processor from the 3-digit code. The 23-bit word is then transferred to a serial shift register and clocked out at a rate of 133 Hz. Connecting the output of the shift register back to its input causes the 23-bit word to be continuously repeated.

12.2.2.2 Shift Register

There are two modes to the DPL generator. During the load mode, the shift-register control (U34 and U36) gates a control latch to the input of the shift register (U20 and U3). Twenty-three data bits and clock pulses are then provided by the processor to load the DPL word. At the completion of the load mode, the shift-register control switches back to the output mode, which cycles the DPL word through the shift register at a 133-Hz clock rate. The 133-Hz clock comes from one of the sinusoidal digital lines on the Audio Synthesizer (U4 PIN 15).

12.2.2.3 Bandpass Filter

Bandpass filter U8, with a 0.2 to 135-Hz bandpass, follows the shift-register output to remove the higher frequency components of the digital signal. For the DPL off-code (133-Hz tone), the processor switches the INT MOD line to the Audio Synthesizer's output, outputting a 133-Hz sinewave.

12.2.3 1-KHz TONE

A filtered, 1-kHz square wave provides the fixed, 1-kHz modulation source. The SYNTH 1 KHz signal from the Processor Interface board (A11) is filtered to less than 1 percent distortion by bandpass filter U46.

12.2.4 INTERNAL MODULATION

The internally generated modulation consists of the output of either the audio synthesizer or the DPL generator.

12.2.5 EXTERNAL MODULATION

External modulation can come from either the microphone input or the external modulation input port (Ext Mod In) on the front panel. An instantaneous deviation-control (IDC) circuit (U45) amplifies and limits the microphone signal (MIC IN) before summing it with the signal EXT MOD IN from the front panel's port. The resulting signal is the EXT MOD source.

12.2.6 MODULATION CONTROL

The three modulation sources, internal, external, and 1-kHz, are level-controlled by either the front panel controls or the IEEE Interface board (A13). The level-adjusted sources are then returned to the Audio Synthesizer board, where they are summed together and dc-adjusted by U38 for 0 Vdc, forming the composite modulation audio. The composite signal is routed to four places: the modulation-select switch, the MOD CAL AUDIO line to the Scope/DVM Control board (A7), the F.P. MOD OUTPUT line to the front panel, and VOL CONTROL AUDIO line to the speaker (for generate modes only).

The modulation-select switch (U24) routes the composite modulation signal to any of the four modulators: to the double sideband-suppressed carrier modulator (DSBSC MOD) for sideband modulation, to the RF Synthesizer for frequency modulation (FM MOD), to the Duplex Generator for frequency modulation (OFFSET MOD), and to the RF output-leveling loop for amplitude modulation. U47 sums the signal for amplitude modulation with a 5-Vdc level and then routes it to the variable RF Level control on the front panel (5 VDC + AM MOD). At the RF Level control, the signal is attenuated according to the level setting to give the dc-plus-AM reference signal for the output-leveling loop.

12.2.7 BOARD CONTROL

The AF bus provides all the control inputs for the Audio Synthesizer board. The 4-bit address bus (AF ADD BUS 0-3) is decoded by the address decoder (U35) to determine which control latch is to be accessed. Control data is transferred to the accessed latch on the 4-bit data bus (AF DATA BUS 0-3). Synchronization of the data transfer is the function of the AF BUS EN 1 signal line.

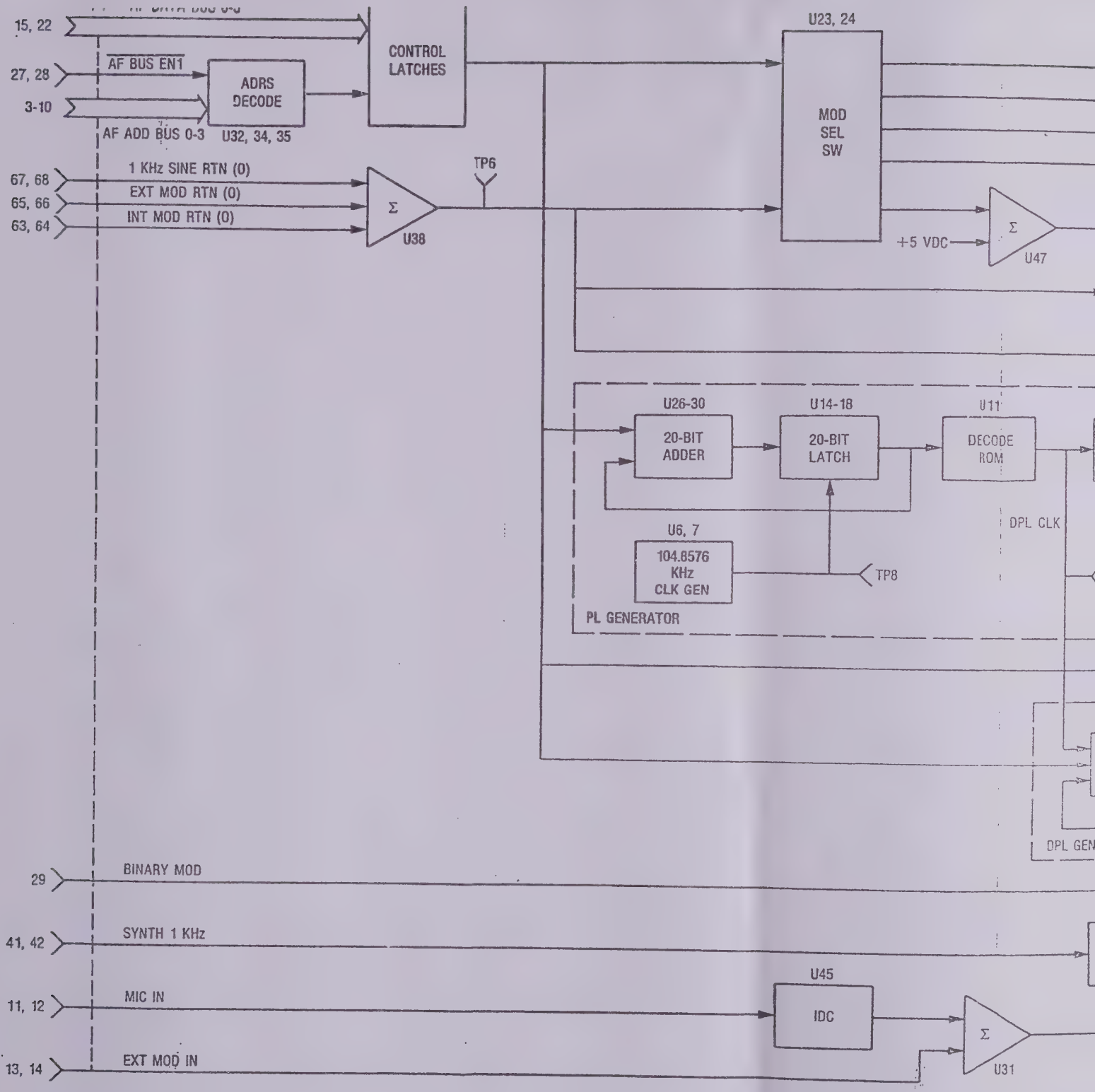
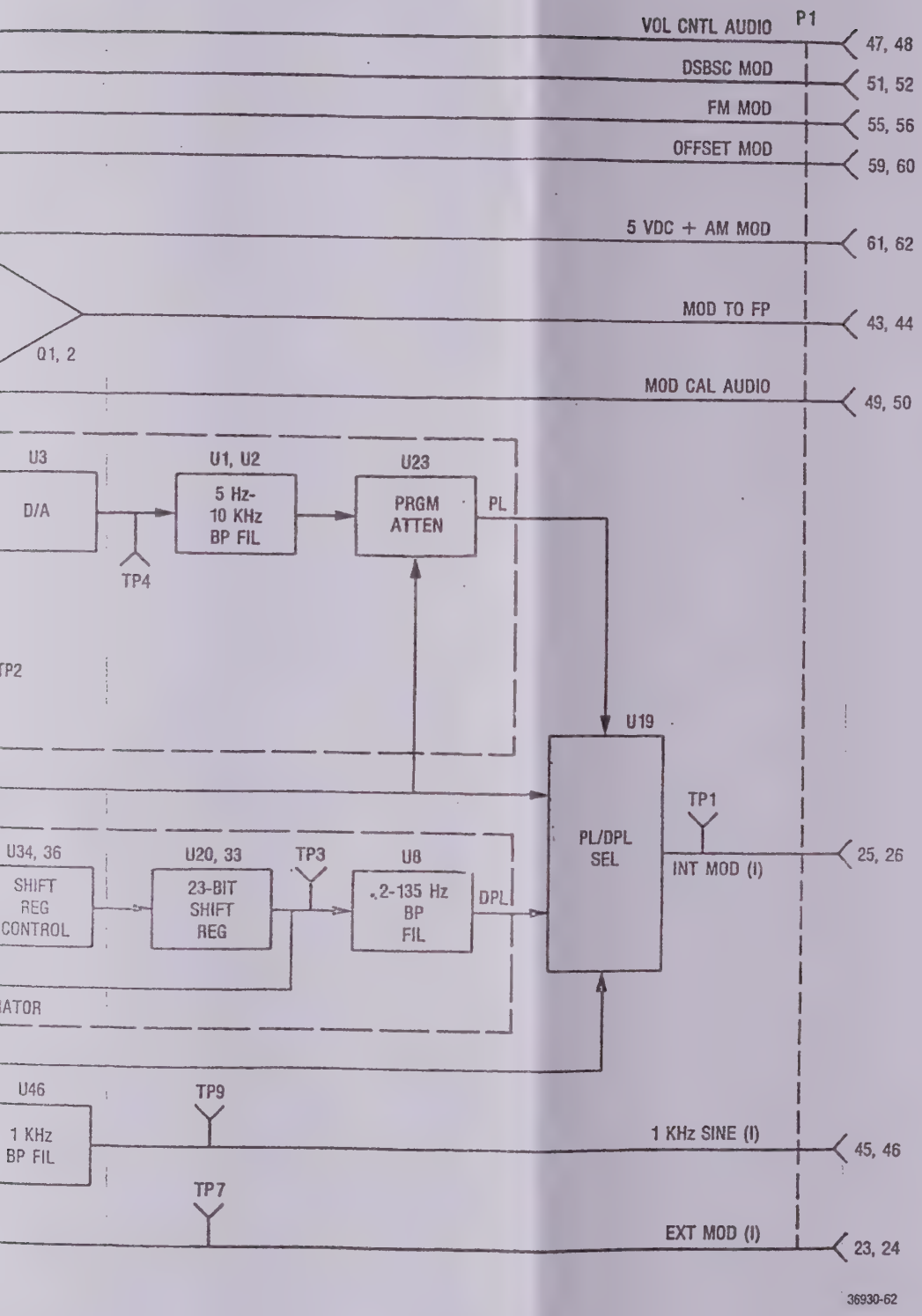

15, 22
AF BUS EN1
27, 28
3-10
AF ADD BUS 0-3
ADRS DECODE
U32, 34, 35
CONTROL LATCHES
U23, 24
MOD SEL SW
67, 68
65, 66
63, 64
1 KHz SINE RTN (0)
EXT MOD RTN (0)
INT MOD RTN (0)
Σ
U38
TP6
+5 VDC
Σ
U47
U26-30
20-BIT ADDER
U14-18
20-BIT LATCH
U11
DECODE ROM
DPL CLK
U6, 7
104.8576 KHz CLK GEN
TP8
PL GENERATOR
DPL GEN
29
BINARY MOD
41, 42
SYNTH 1 KHz
U45
11, 12
MIC IN
IDC
Σ
U31
13, 14
EXT MOD IN

Figure 12-1. Block Diagram

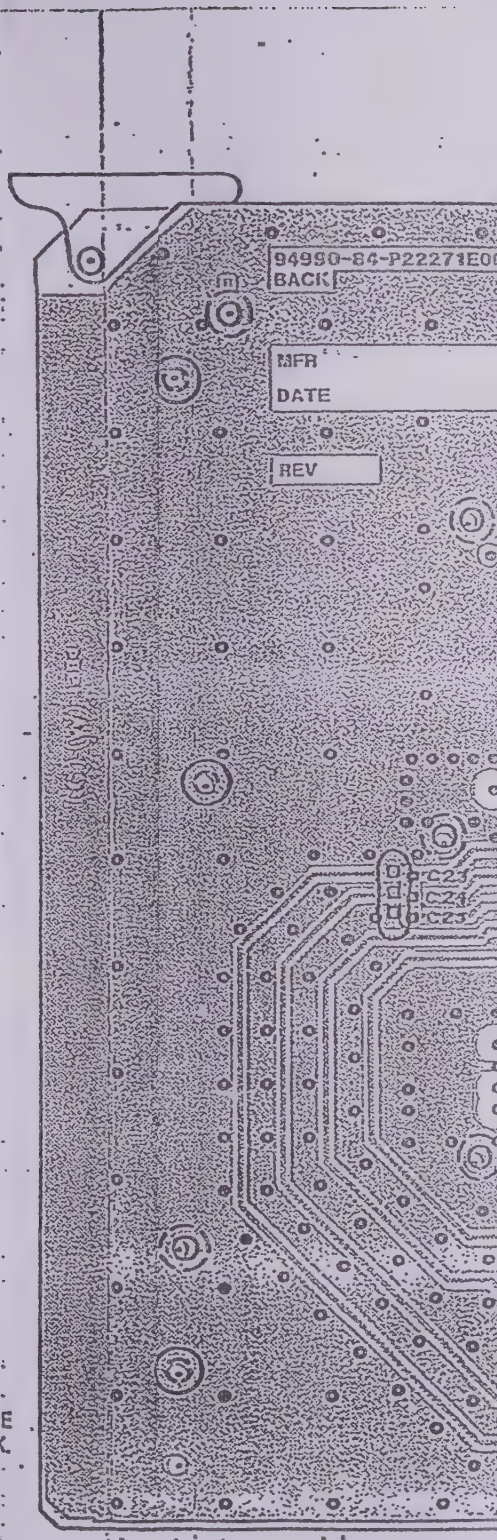


RF SYNTHESIZER

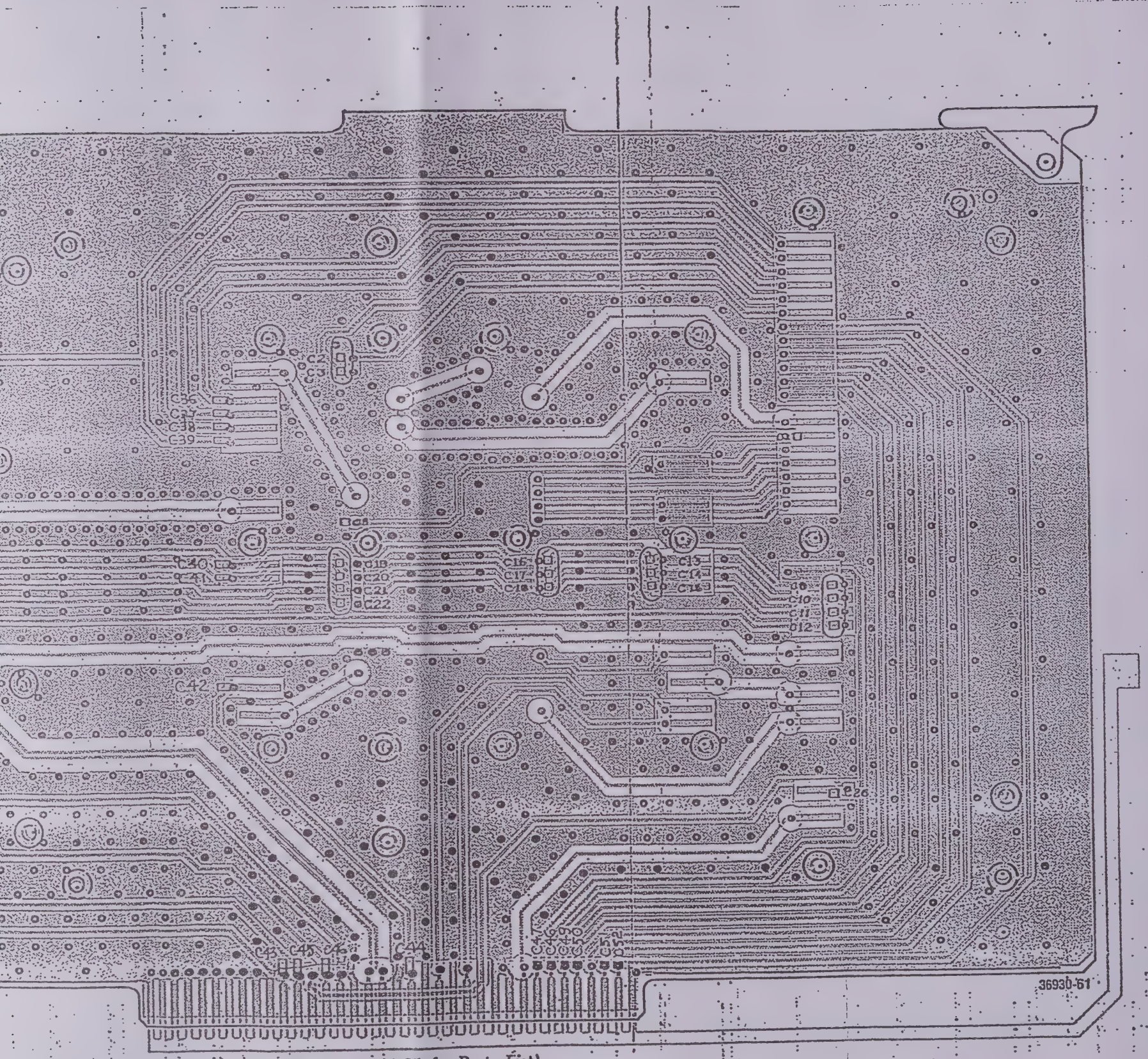
SYNTHESIZER MOTHERBOARD (A9A7)

(RTC-4045A)

Figure 11-21b. Printed Wiring Board Assembly and Parts List (Sheet 2 of 2)



COMPONENTS AND BACKSIDE OF BOARD SHOWN IN BLACK.
INNER LAYER OF BOARD SHOWN IN ORANGE



(See Sheet 1, p. 11-35, for Parts List)

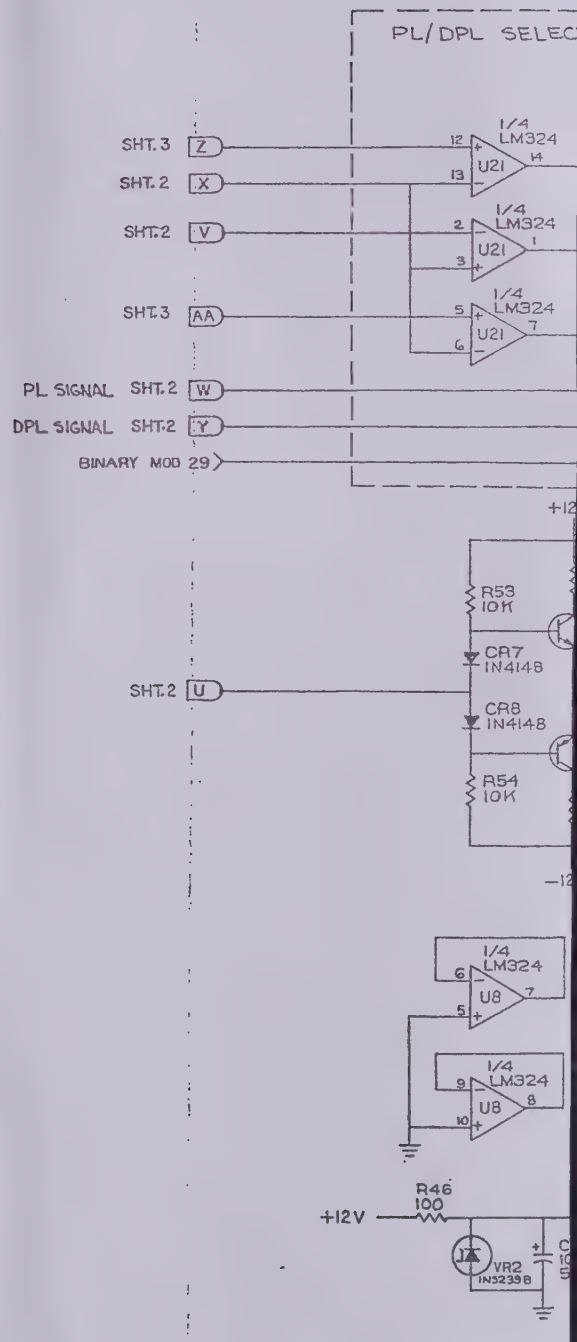
AUDIO SYNTHESIZER BOARD (A10)

(RTC-1008A)

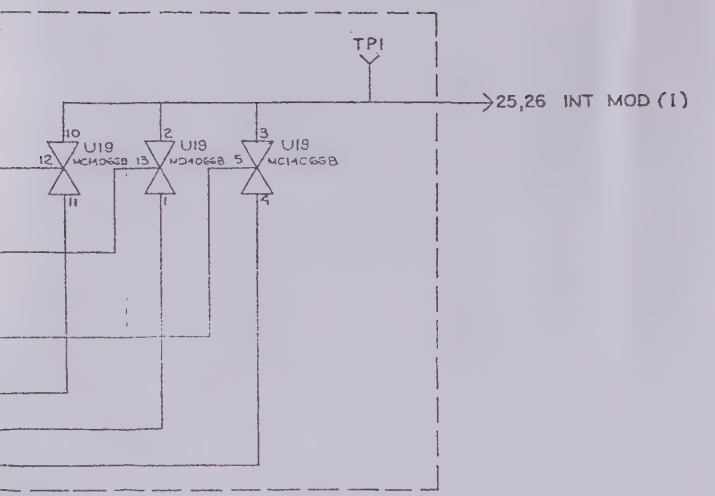
Figure 12-2a. Schematic (Sheet 1 of 3)

NOTES:

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH 1A6.
2. FOR REFERENCE DRAWINGS REFER TO ASSY. NO. 01-P00426N.
3. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS ± 5% PCT, 1/4 WATT(S).
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY



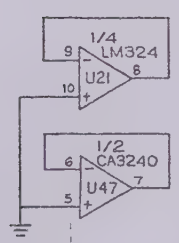
R55
100

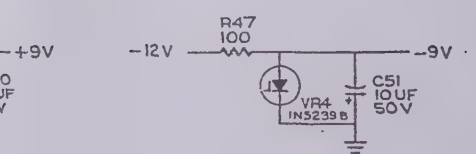
Q3
MPS6520

51,52 DSBSC MOD

Q4
MPS6519

R56
100





REF DES	DEVICE TYPE	GND	+5V	-5V	+12V	-12V	NO CONN
U1	CA3240E	3			8	4	
U2	CA3240E	5			8	4	
U3	MC1408P8	1,2	13			3,16	
U4	MC14175BCP	8	16				3,6,11,14
U5	MC14175BCP	8	16				3,6,11,14
U6	SN74LS90N	2,3,6,7,10	5				4,8,9,13
U7	SN74LS04N	7	14,9,11				8,10
U8	MLM324N	5,10	4	11			
U9							
U10							
U11	MM2716Q	12,18,20	21,24				
U12							
U13							
U14	MC14175BCP	8	16				3,6,11,14
U15	MC14175BCP	8	16				3,6,11,14
U16	MC14175BCP	8	16				3,6,11,14
U17	MC14175BCP	8	16				3,6,11,14
U18	MC14175BCP	8	16				3,6,11,14
U19	MC14066BCP		14	6,7			8,9
U20	MC14006BCP	7	14				1,2,5,6,8,9,10,11,13
U21	MLM324N	10	4	11			
U22	LM324N						14,+9/4,-9/11
U23	MC14066BCP	9,10					1,2,+9,14-9/7,13
U24	MC14066BCP						+9V/14,-9V/7
U25	LM324N						+9/4,-9/11
U26	MC14008BCP	8	16				
U27	MC14008BCP	1,3,8	16				14
U28	MC14008BCP	8	16				
U29	MC14008BCP	8	16				
U30	MC14008BCP	8,9	16				
U31	CA3140E	3			7	4	5,8
U32	MC14011BCP	1,2,5,7	14				3,4,6
U33	MC14006BCP	7	14				2,8,11
U34	MC14011BCP	7	1,2,14				3
U35	MC14028BCP	8	16				5,9
U36	MC14011BCP	7	14				
U37	MC14042BCP	8	16				3,9,12,15
U38	CA3240E	5			8	4	
U39	MC14042BCP	8	16				3,9,12,15
U40	MC14042BCP	8	16				3,9,12,15
U41	MC14042BCP	8	16				3,9,15
U42	MC14042BCP	8	16				3,9,12,15
U43	MC14042BCP	8	16				3,9,12,15
U44	MC14042BCP	8	16				3,9,12,15
U45	IDC	3					2
U46	CA3240E	3,5			8	4	
U47	CA3240E	5			8	4	
U48	MC14042BCP	8	16				2,3,9,10,11,12,15

LAST USED	NOT USED
C61	C46, C58
CR8	CR1,CR2,CR3,CR4
L3	
Q5	
R68	R12,R18,R20,R21,R22,R44,R61
U48	U9,U10,U12,U13
VR9	VR3,VR5,VR6,VR7,VR8
Y1	

36930-64A

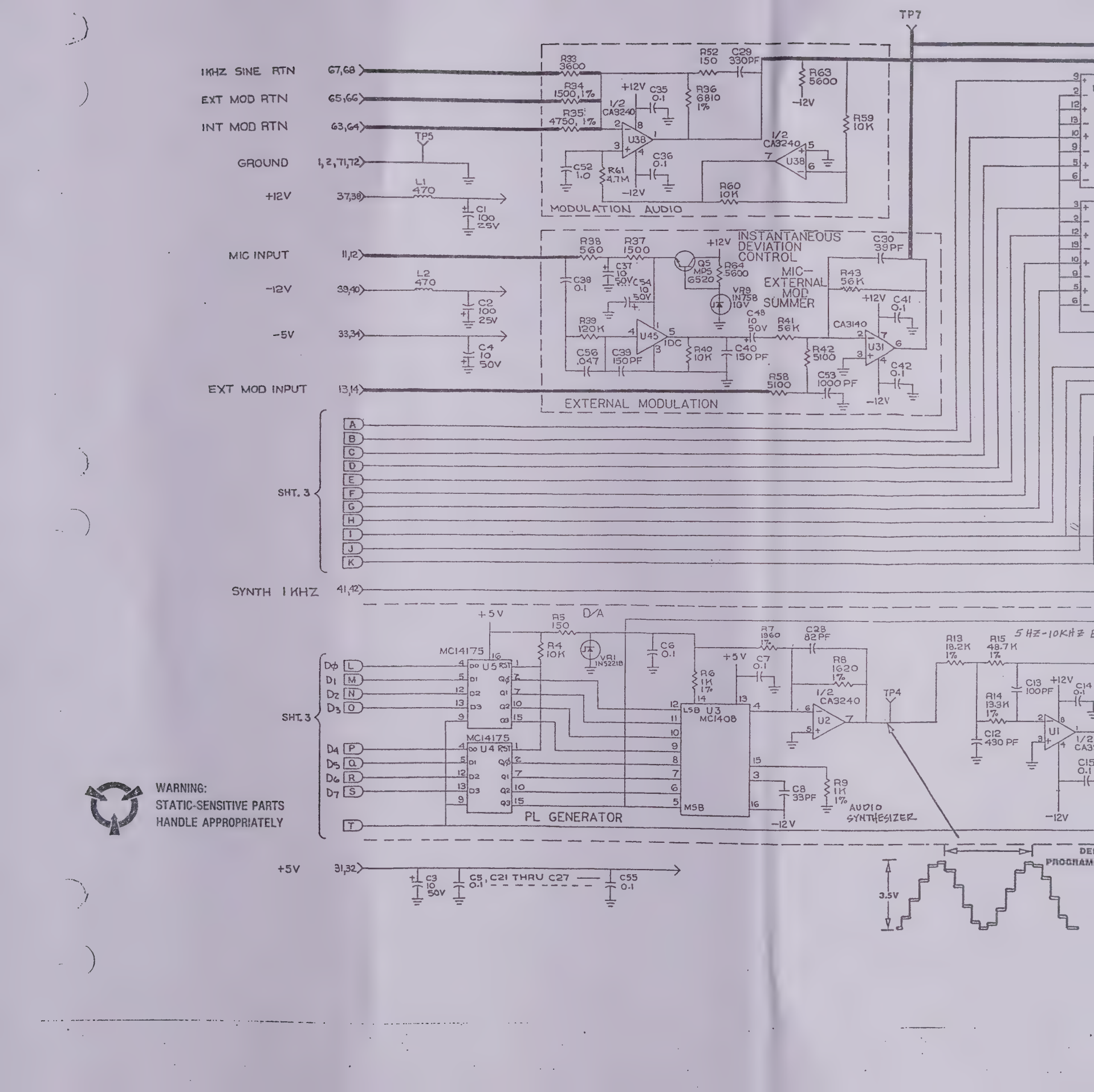
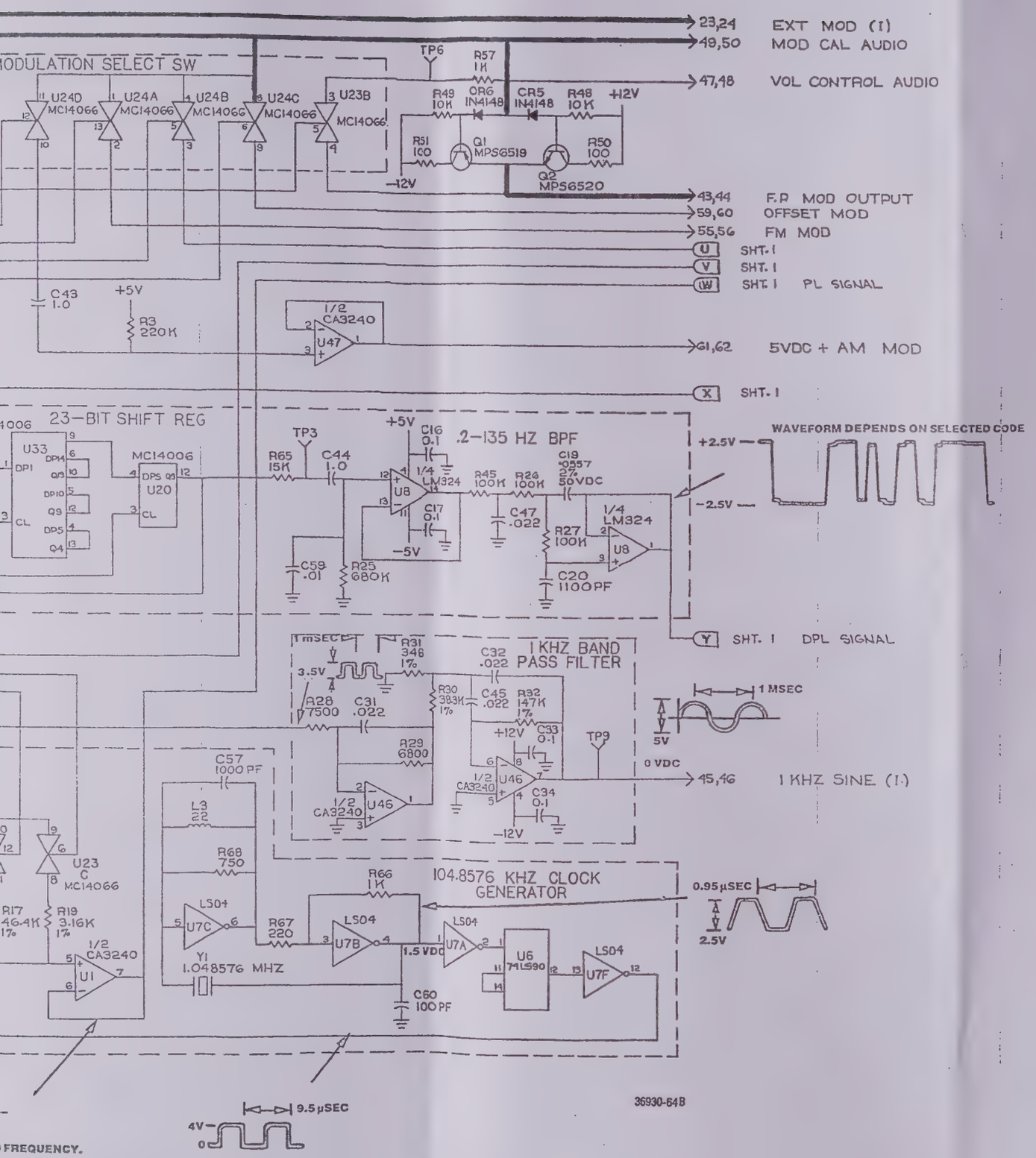
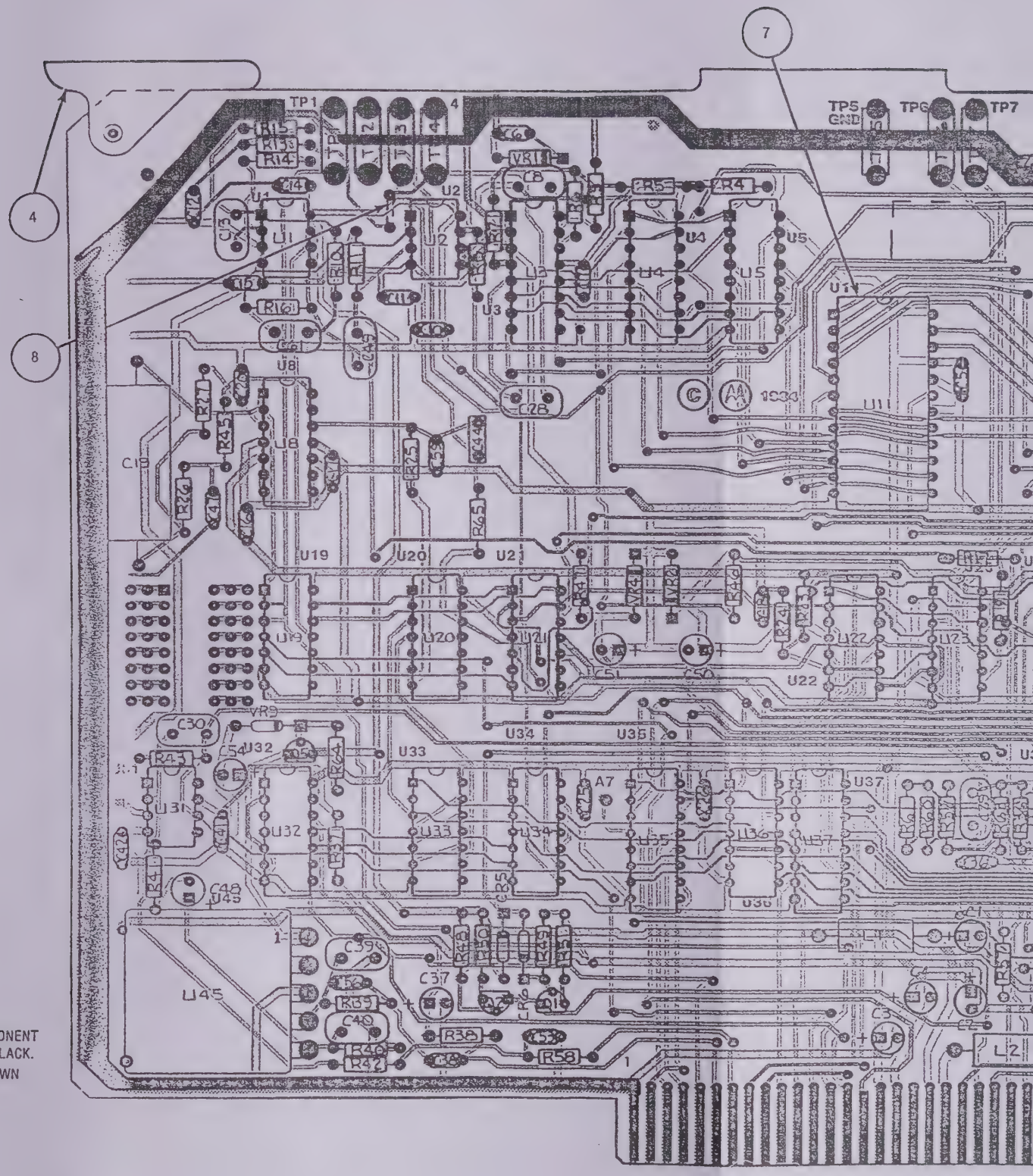

1KHZ SINE RTN
EXT MOD RTN
INT MOD RTN
GROUND
+12V
MIC INPUT
-12V
-5V
EXT MOD INPUT
SHT. 3
SYNTH 1 KHZ
+5V
67,68
65,66
63,64
1,2,71,72
37,38
11,12
39,40
33,34
13,14
41,42
31,32
TP5
TP7
TP4
L1 470
C1 100 25V
L2 470
C2 100 25V
C4 10 50V
MODULATION AUDIO
R33 3600
R34 1500,1%
R35 4750, 1%
R52 150
C29 330PF
R63 5600
R36 6810 1%
R59 10K
R60 10K
C35 0.1
C36 0.1
C52 1.0
R61 4.7M
1/2 CA3240
U38
INSTANTANEOUS DEVIATION CONTROL
R38 560
R37 1500
C37 10 50V
C38 0.1
C54 10 50V
Q5 MPS 6520
R64 5600
VR8 IN758 10V
C30 39PF
MIC-EXTERNAL MOD SUMMER
R43 56K
C41 0.1
C48 10 50V
R39 120K
R41 56K
U45
1DC
C56 .047
C39 150PF
R40 10K
C40 150 PF
R42 5100
U31
C42 0.1
C53 1000 PF
R58 5100
EXTERNAL MODULATION
D/A
R5 150
R4 10K
VR1 IN5221B
C6 0.1
MC14175
U5
U4
D0 L
D1 M
D2 N
D3 O
D4 P
D5 Q
D6 R
D7 S
T
LSB U3 MC1408
MSB
R6 1K 1%
R7 1960 1%
C28 82PF
C7 0.1
R8 1620 1%
U2
R9 1K 1%
C8 33PF
AUDIO SYNTHESIZER
PL GENERATOR
R13 18.2K 1%
R15 48.7K 1%
R14 13.3K 1%
C12 430 PF
C13 100PF
U1
C14 0.1
C15 0.1
5HZ-10KHZ
C3 10 50V
C5, C21 THRU C27 0.1
C55 0.1
3.5V
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

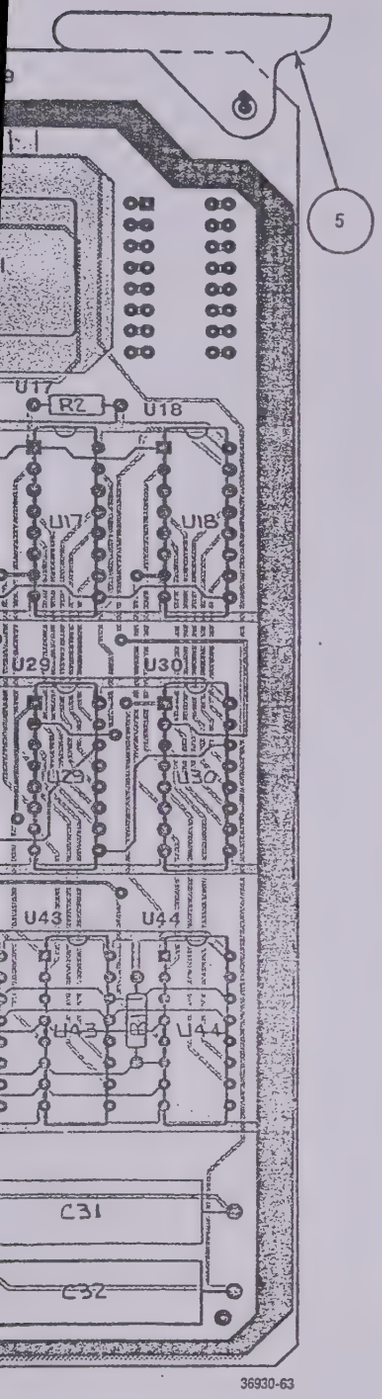
Figure 12-2b. Schematic (Sheet 2 of 3)



FREQUENCY.
MODE SELECTED.



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE



Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
004	1	45-80339B28	CARD EJECTOR	
005	1	45-80339B29	CARD EJECTOR	MARKED
C 001	1	23-84665F03	CAPACITOR	100UF-20-25
C 002	1	23-84665F03	CAPACITOR	100UF-20-25
C 003	1	23-80341B15	CAPACITOR	10UF-20-50
C 004	1	23-80341B15	CAPACITOR	10UF-20-50
C 005	1	21-80342B10	CAPACITOR	.1UF-20-50
C 006	1	21-80342B10	CAPACITOR	.1UF-20-50
C 007	1	21-80342B10	CAPACITOR	.1UF-20-50
C 008	1	21-80369A90	CAPACITOR	33PF-5-500
C 010	1	21-80342B10	CAPACITOR	.1UF-20-50
C 011	1	21-80342B10	CAPACITOR	.1UF-20-50
C 012	1	21-80341B80	CAPACITOR	430PF-5-50
C 013	1	21-00850118	CAPACITOR	100PF-5-500
C 014	1	21-80342B10	CAPACITOR	.1UF-20-50
C 015	1	21-80342B10	CAPACITOR	.1UF-20-50
C 016	1	21-80342B10	CAPACITOR	.1UF-20-50
C 017	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	21-80342B10	CAPACITOR	.1UF-20-50
C 019	1	08-84326A27	CAPACITOR	.0557UF-2-50
C 020	1	21-80341B47	CAPACITOR	1100PF-5-50
C 021	1	21-80342B10	CAPACITOR	.1UF-20-50
C 022	1	21-80342B10	CAPACITOR	.1UF-20-50
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 024	1	21-80342B10	CAPACITOR	.1UF-20-50
C 025	1	21-80342B10	CAPACITOR	.1UF-20-50
C 026	1	21-80342B10	CAPACITOR	.1UF-20-50
C 027	1	21-80342B10	CAPACITOR	.1UF-20-50
C 028	1	21-80339B18	CAPACITOR	82PF-5-500
C 029	1	21-80339B19	CAPACITOR	330PF-5-100
C 030	1	21-80339B15	CAPACITOR	39PF-5-500
C 031	1	08-84326A48	CAPACITOR	.022UF-1-50
C 032	1	08-84326A48	CAPACITOR	.022UF-1-50
C 033	1	21-80342B10	CAPACITOR	.1UF-20-50
C 034	1	21-80342B10	CAPACITOR	.1UF-20-50
C 035	1	21-80342B10	CAPACITOR	.1UF-20-50
C 036	1	21-80342B10	CAPACITOR	.1UF-20-50
C 037	1	23-80341B15	CAPACITOR	10UF-20-50
C 038	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	21-80369A94	CAPACITOR	150PF-5-500
C 040	1	21-80369A94	CAPACITOR	150PF-5-500
C 041	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	21-80342B10	CAPACITOR	.1UF-20-50
C 043	1	21-80342B46	CAPACITOR	1UF-20-50
C 044	1	21-80342B46	CAPACITOR	1UF-20-50
C 045	1	08-84326A48	CAPACITOR	.022UF-1-50
C 047	1	21-80342B01	CAPACITOR	.022UF-10-100
C 048	1	23-80341B15	CAPACITOR	10UF-20-50
C 049	1	21-80339B15	CAPACITOR	39PF-5-500
C 050	1	23-80341B15	CAPACITOR	10UF-20-50
C 051	1	23-80341B15	CAPACITOR	10UF-20-50
C 052	1	21-80342B46	CAPACITOR	1UF-20-50
C 053	1	21-80341B92	CAPACITOR	1000PF-10-100
C 054	1	23-80341B15	CAPACITOR	10UF-20-50
C 055	1	21-80342B10	CAPACITOR	.1UF-20-50
C 056	1	21-80342B13	CAPACITOR	.047UF-20-50
C 057	1	21-80341B46	CAPACITOR	1000PF-5-50
C 059	1	21-80341B95	CAPACITOR	.01UF-20-100
C 060	1	21-00850118	CAPACITOR	100PF-5-500
C 061	1	21-80339B22	CAPACITOR	270PF-5-300
CR005	1	48-84463K02	DIODE	
CR006	1	48-84463K02	DIODE	
CR007	1	48-84463K02	DIODE	
CR008	1	48-84463K02	DIODE	
L 001	1	24-80348A83	COIL	470UH
L 002	1	24-80348A83	COIL	470UH
L 003	1	24-80369A31	COIL	22UH
Q 001	1	48-80340B85	TRANSISTOR	MPS6519
Q 002	1	48-80340B86	TRANSISTOR	MPS6520
Q 003	1	48-80340B86	TRANSISTOR	MPS6520
Q 004	1	48-80340B85	TRANSISTOR	MPS6519
Q 005	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-11009C73	RESISTOR	10K-5-1/4
R 002	1	06-11009C73	RESISTOR	10K-5-1/4
R 003	1	06-11009D06	RESISTOR	220K-5-1/4
R 004	1	06-11009C73	RESISTOR	10K-5-1/4
R 005	1	06-11009C29	RESISTOR	150-5-1/4
R 006	1	06-10621B94	RESISTOR	1K-1-1/4
R 007	1	06-10621C23	RESISTOR	1.96K-1-1/4
R 008	1	06-10621C15	RESISTOR	1.62K-1-1/4
R 009	1	06-10621B94	RESISTOR	1K-1-1/4
R 010	1	06-10621D62	RESISTOR	53.6K-1-1/4

Figure 12-3. Printed Wiring Board Assembly and Parts List

SECTION 13.
PROCESSOR INTERFACE BOARD (A11)

13.1 DESCRIPTION

The Processor Interface board contains the digital voltmeter (DVM), frequency counter, system timer, and the processor interface for the two system control busses: audio frequency (AF bus) and radio frequency (RF bus). The DVM can measure both dc and ac rms (root-mean-square) voltages. The frequency counter uses two different measuring techniques: the direct count and the reciprocal count.

A block diagram of the Processor Interface board is shown at the end of this section in Figure 13-1, a schematic in Figure 13-2, and the printed wiring board assembly and parts list in Figure 13-3.

13.2 THEORY OF OPERATION

13.2.1 SYSTEM CONTROL-BUS INTERFACE

13.2.1.1 General

Interface between the processor busses and the system is through peripheral-interface adapters (PIA). The PIA is a single integrated-circuit chip that provides 16 input/output latches (PA0-PA7 and PB0-PB7) which can either be read from or written into by the processor. The PIA also contains four control lines: two of these, CA1 and CB1, act as input-only lines for processor interrupts, and the other two, CA2 and CB2, act as output-only control lines. The two system control busses (AF and RF) use a single PIA (U1).

13.2.1.2 AF Control Bus

The AF control bus consists of eight lines split into four data lines (PB0-PB3) and four address lines (PB4-PB7). The address lines define the particular latch in which the data is to be stored, or the buffer from which data is to be obtained. One additional address line, the bus-enable line, is required to enable the address-decoding circuitry. The AF control bus has two bus-enable lines, $\overline{\text{AF BUS EN 1}}$ and $\overline{\text{AF BUS EN 2}}$, which provide a total control-bus capability of 128 bits. The $\overline{\text{AF BUS EN 2}}$ line enables the address-decoder circuitry on the Front-Panel Interface board (A15) and the Processor Interface board (A11). The $\overline{\text{AF BUS EN 1}}$ line, which comes from the Processor board (A14), enables the address-decoder circuitry on the Scope/DVM Control board (A7) and the Audio Synthesizer board (A10).

13.2.1.3 RF Control Bus

The RF control bus is a clocked serial bus which consists of five data lines (PA1, PA3-PA6), a data clock line (CA2), and a latch line (PA7). The data stream is 24 bits long. Four of these data lines (OFFSET DATA, 310-440 DATA, 24 DATA, and 60.5 DATA) program the phase-locked-loop (PLL) ICs on the Duplex Generator and the RF Synthesizer. These ICs disregard the first 5 bits of the serial data stream and latch-in the last 19 bits. The other data line, PA6 system control, controls the Receiver board (A8) and RF Synthesizer board (A9). The RF Synthesizer is programmed by the first 8 bits of the system-control data line, and the Receiver by the last 16 bits.

13.2.1.4 Timer

The timer (U35) provides interval timing to the processor for tone encoding and decoding and other functions. In the encode interval-timing mode, the processor programs the desired interval and initiates the timer with control words on the data lines and an enable pulse on the E line. The timer will interrupt the processor when the programmed interval is completed. In the decode interval-timing mode, the processor will start and stop the timer. The processor will then read the interval time from the timer. The timer reference frequency is the SYNTH 1 KHz, a 1-kHz square wave locked to the system's reference frequency.

13.2.2 DIGITAL VOLTMETER (DVM)

13.2.2.1 General

The DVM measures either the nine internal voltage points or the external voltages. The levels of the inputs to the DVM are auto-ranged for 3-digit accuracy. The DVM consists of an analog-to-digital (A/D) converter, a root-mean-square (rms) converter, and the DVM/FREQ COUNTER PIA which provides the interface between the DVM and the processor.

13.2.2.2 A/D Converter

The A/D converter (U29) converts positive dc voltages between 0 and 1023 mV into a 10-bit digital word. For negative voltages, the signal is converted to a positive voltage by the rms converter (U27), with the

polarity information detected by the SIGN DETECTOR (U34). The information bit for the sign detector is latched into the DVM/counter buffer (U20). The processor initiates an A/D conversion with a pulse on the start line (U29 PIN21). The A/D converter signals the processor that the conversion is complete by a pulse on the end line (U29 PIN23). The processor, in turn, enables the output drivers on the A/D, sets the DVM/COUNTER buffer to the DVM mode, and inputs the 10-bit word from the A/D and the sign bit.

13.2.2.3 Internal DVM

Internal DVM voltages in the System Analyzer are all positive and proportional to certain parameters in the system. (See Section 9, Scope/DVM Control board A7, paragraph 9.2.8.2.) These signals are auto-ranged over two decades to a 0 to 1-Vdc range on the A7 board and routed to the INT DVM TO A/D input on the A11 board. The processor makes an internal measurement by selecting the internal path which routes the signal directly to the A/D converter for conversion, as described in paragraph 13.2.2.2.

13.2.2.4 External DVM

13.2.2.4.1 General

In the external DVM mode, voltages applied to the input jack on the front panel are auto-ranged on the Front-Panel Interface board (A15) to provide four full-scale displays of 1, 10, 100, and 300V. From A15, the signal is passed directly through the A7 board to the EXT DVM TO A/D input on the A11 board. The resulting dynamic voltage range at the EXT DVM TO A/D input is 0 to 1 Vrms. This signal is amplified at U28 by a voltage gain of 3.5 and applied to the rms-to-dc converter. The resulting output is applied to attenuator R22 with a voltage gain of 1/3.5. The amplifier and attenuator allow the rms-to-dc converter to work with larger signal levels. This provides a net increase in conversion speed. The output of the attenuator is then routed to the A/D converter for conversion, as described in paragraph 13.2.2.2.

13.2.2.4.2 DC/AC Mode

In the dc mode, inputs are low-pass filtered in the A15 board before entering the A11 board. The rms-to-dc converter reads true rms; therefore, the output for a dc input is the positive square root of the input square — that is, the absolute value of the input voltage. The polarity of the signal is determined by the sign detector, U34. In the ac mode, inputs are capacitor-coupled in the A15 board. Therefore, only the rms voltage of the ac component is measured.

13.2.2.5 Distortion Reading

In the distortion-measurement mode, the 1-kHz fundamental of the input is filtered out by a notch filter on the A7 board. The distortion products are routed to the EXT DVM TO A/D input of the A11 board for input to the processor by the A/D converter. The input to the notch filter is rectified and averaged on the A7 board and then routed through the internal DVM circuitry for measurement. To obtain the percent of distortion for a 1-kHz input signal, the processor divides the rms output voltage of the notch filter by the average rectified input voltage to the notch filter.

13.2.3 FREQUENCY COUNTER

13.2.3.1 General

The frequency counter uses two methods to determine frequency: direct counting and reciprocal counting. In this manual the direct method will be called "frequency counter" and the reciprocal method will be called "period counter."

In the direct method, the counter counts cycles of the unknown signal for a precisely known length of time, called a gate time. The resolution of the measured signal is directly proportional to the gate time, one Hertz in one second. The reciprocal method measures frequency by counting the number of internal clock cycles per one period of the unknown signal. This technique makes the resolution of the measured frequency proportional to the frequency of the internal clock. For a 1-MHz internal clock, the measurement of a 1-kHz signal would take 1 msec and provide a resolution of 1 Hz.

Three possible signal sources are available to the frequency counter for frequency determination. The desired signal is selected and sent to the counter by select switch U8. For external inputs, the EXTERNAL COUNTER lines from the Front-Panel Interface board (A15) provide the input which is buffered by U3B, Q4 and Q5 on the A11 board. The signal for off-the-air tone-sequence decode is DEMOD CAL AUDIO, which is routed through the A7 board to the INT SCOPE TO RNG SW line. This signal is connected to A15, where it is routed through the range switch to the EXTERNAL COUNTER input. Monitor frequency error is determined from the IF/BFO FREQ line by comparing that frequency to 700 kHz.

13.2.3.2 Frequency Counter

The frequency counter consists of a gate-time generator (U9-U13), an accumulator (U18, U19), a buffer (DVM/COUNTER BUFFER U20-U22), a PIA (U2, as described in paragraph 13.2.1.1), and control circuitry

(U15, U16, U17B). The control circuitry and the gate-time generator are sequentially gated by a 1-kHz clock. A measurement cycle for the frequency counter begins with a START pulse from PIA line CA2. This pulse resets the gate-time generator and clears the accumulator via the control circuitry (U16A and U16B). On the next cycle of the 1-kHz clock, the accumulator input gate (U17B) is enabled by the control circuitry (U15A). The accumulator will total the cycles of the unknown signal until the time-out of the gate timer or until an accumulator overflow is detected by U8D, U17A, and U17C. This will disable the accumulator input and signal the processor (via the PIA pin, CA1) that the count is complete. The processor, in turn, disables the A/D output drivers, switches the DVM/COUNTER BUFFER to the counter mode, and inputs the 16-bit accumulator information.

The gate-time generator provides gate times of 0.001, 0.01, 0.1, 1, and 10 seconds, which translate to resolutions of 1000, 100, 10, 1, and 0.1 Hz. These gate times are user-selectable or can be auto-selected by the processor to give a 5-digit frequency display with a resolution of 0.1 Hz.

13.2.3.3 Period Counter

The period counter consists of a clock generator (U46-U49), a positive-edge detector (U39B), control circuitry (U36-40), and the same accumulator, buffer, and PIA as the frequency counter. The control circuitry is sequentially gated at the same rate as the clock generator. A period-counter measurement begins with a START pulse from PIA line CA2. This pulse clears the accumulator (U18, U19) and control circuitry (U38, U39A). The period counter then waits for U39B to detect a positive rising edge of the unknown signal. When a positive edge is detected, the control circuitry will enable the accumulator input gate (U40B). The accumulator will count the cycles of the period-counter clock until the next positive rising edge of one period of the unknown signals. This will disable the accumulator input and signal the processor (via PIA pin CA1) that the count is complete. The processor will then input the data as described above for the frequency counter.

The period-counter clock generator (U47-U49) takes the RF Synthesizer's 10-MHz signal and divides it down to 1 MHz and 100 kHz. These three signals (10 MHz, 1 MHz, and 100 kHz) are selected and sent to the counter by switch U46. These clock rates produce period-counter resolutions of 0.1 Hz, 1 Hz, 10 Hz, 100 Hz, and 1 kHz. The resolutions are user-selectable or can be auto-selected by the processor.

13.2.4 BOARD CONTROL

The processor on the AF control bus controls this board. The 4-bit address (AF ADD BUS 0-3) is decoded by the address decoder (U5, U33, U43) to determine in which control latch (U6, U7, or U42) the control data is to be stored. The four data bits (AF DATA BUS 0-3) are then stored in the selected control latch by a pulse on the $\overline{\text{AF BUS EN 2}}$ line.

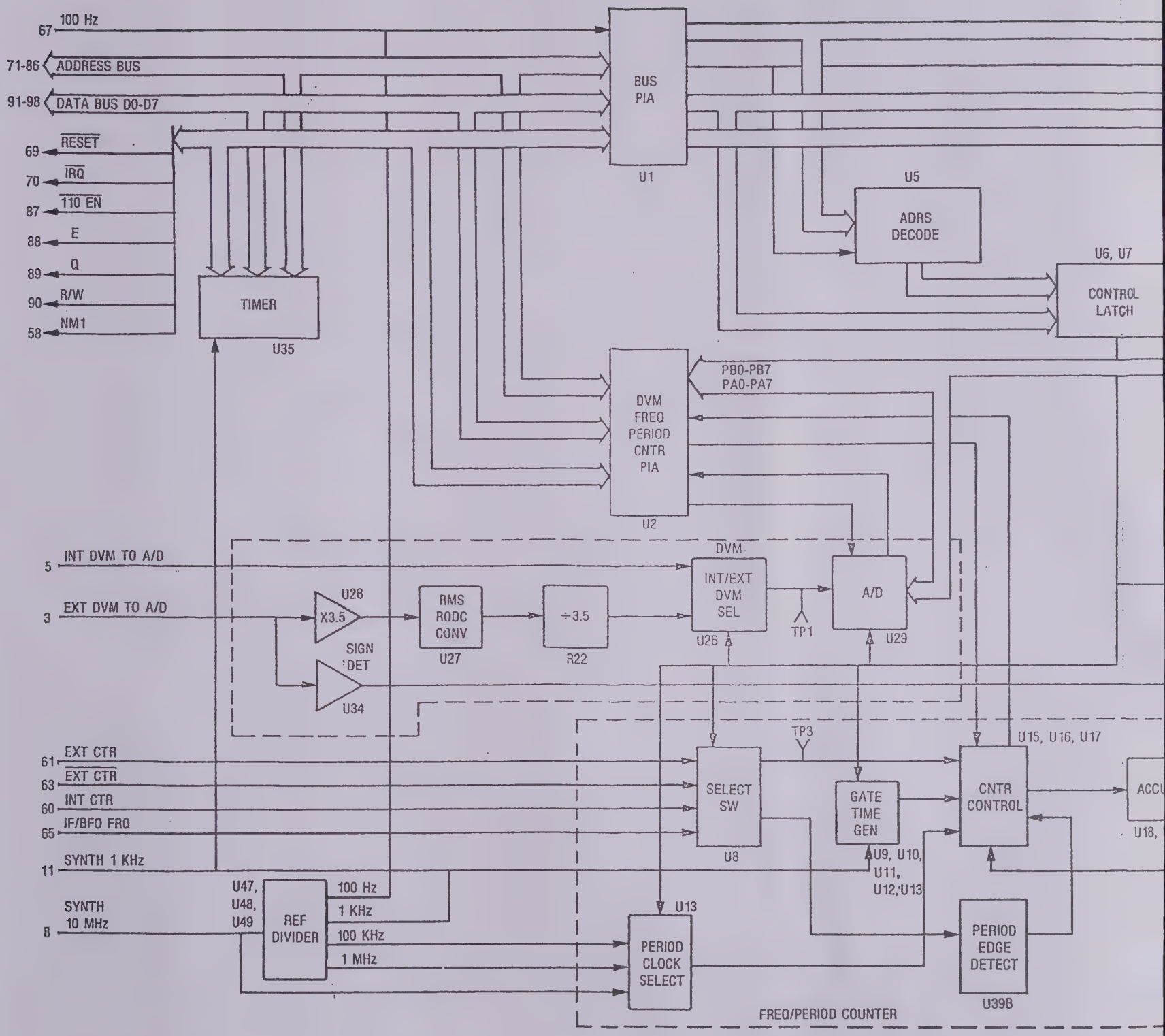
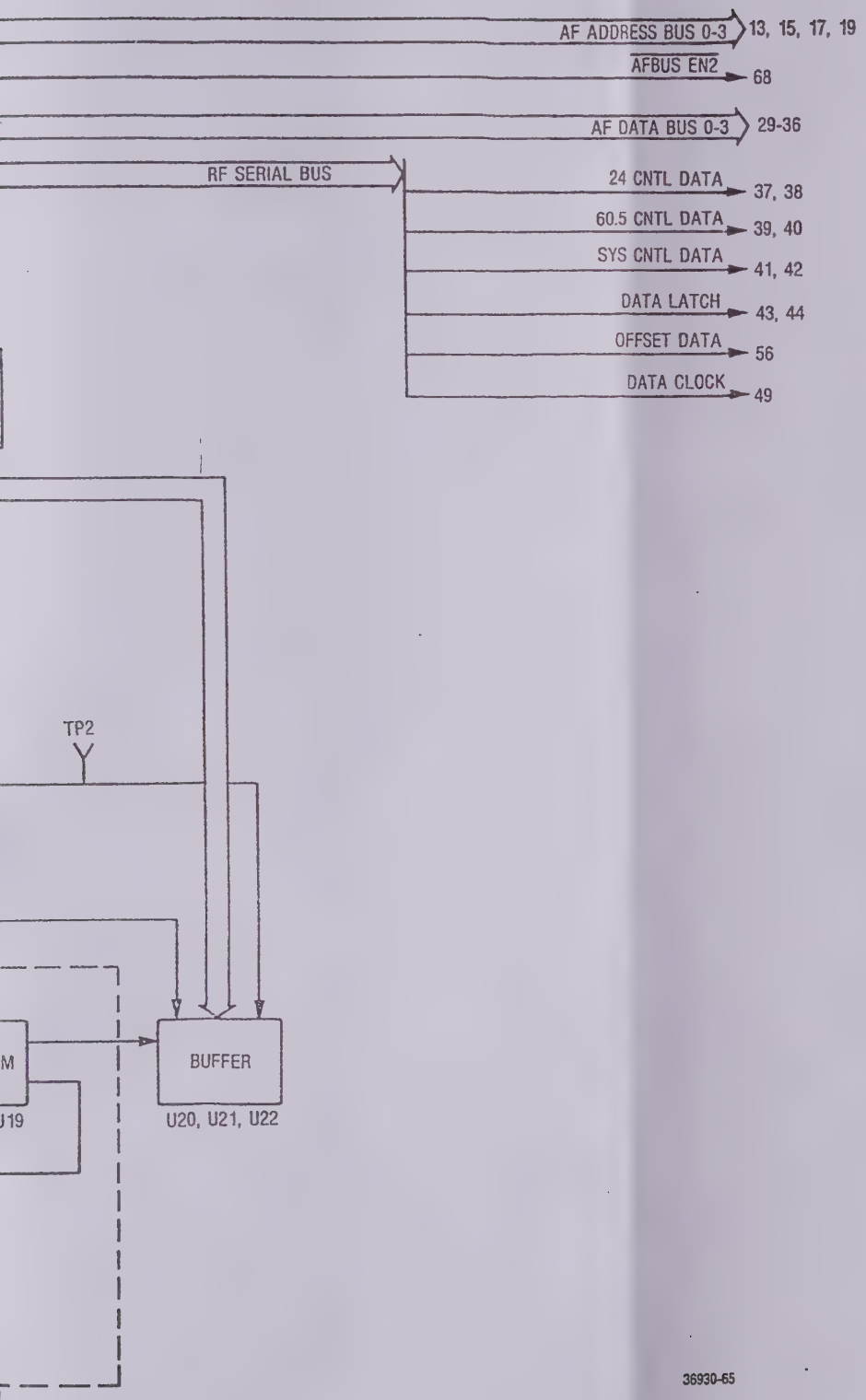
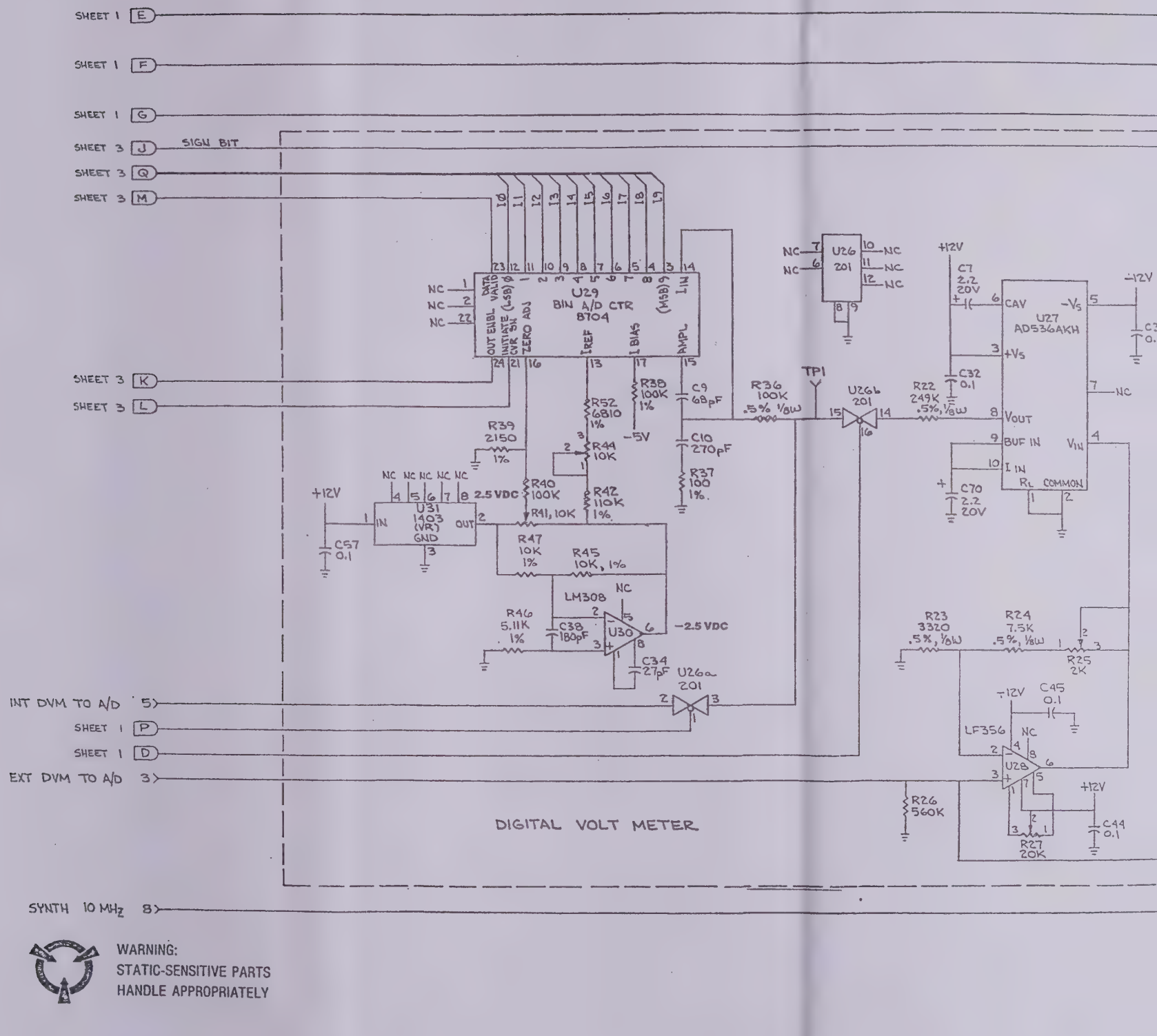

67 100 Hz
71-86 ADDRESS BUS
91-98 DATA BUS D0-D7
69 RESET
70 IRQ
87 110 EN
88 E
89 Q
90 R/W
58 NM1
BUS PIA
U1
U5
ADRS DECODE
U6, U7
CONTROL LATCH
TIMER
U35
DVM FREQ PERIOD CNTR PIA
U2
PB0-PB7
PA0-PA7
5 INT DVM TO A/D
3 EXT DVM TO A/D
U28
X3.5
SIGN DET
U34
RMS RODC CONV
U27
÷3.5
R22
DVM
INT/EXT DVM SEL
U26
TP1
A/D
U29
TP3
U15, U16, U17
61 EXT CTR
63 EXT CTR
60 INT CTR
65 IF/BFO FRQ
11 SYNTH 1 KHz
SELECT SW
U8
GATE TIME GEN
U9, U10, U11, U12, U13
CNTR CONTROL
ACCU
U18,
SYNTH 10 MHz
8
U47, U48, U49
REF DIVIDER
100 Hz
1 KHz
100 KHz
1 MHz
U13
PERIOD CLOCK SELECT
PERIOD EDGE DETECT
U39B
FREQ/PERIOD COUNTER

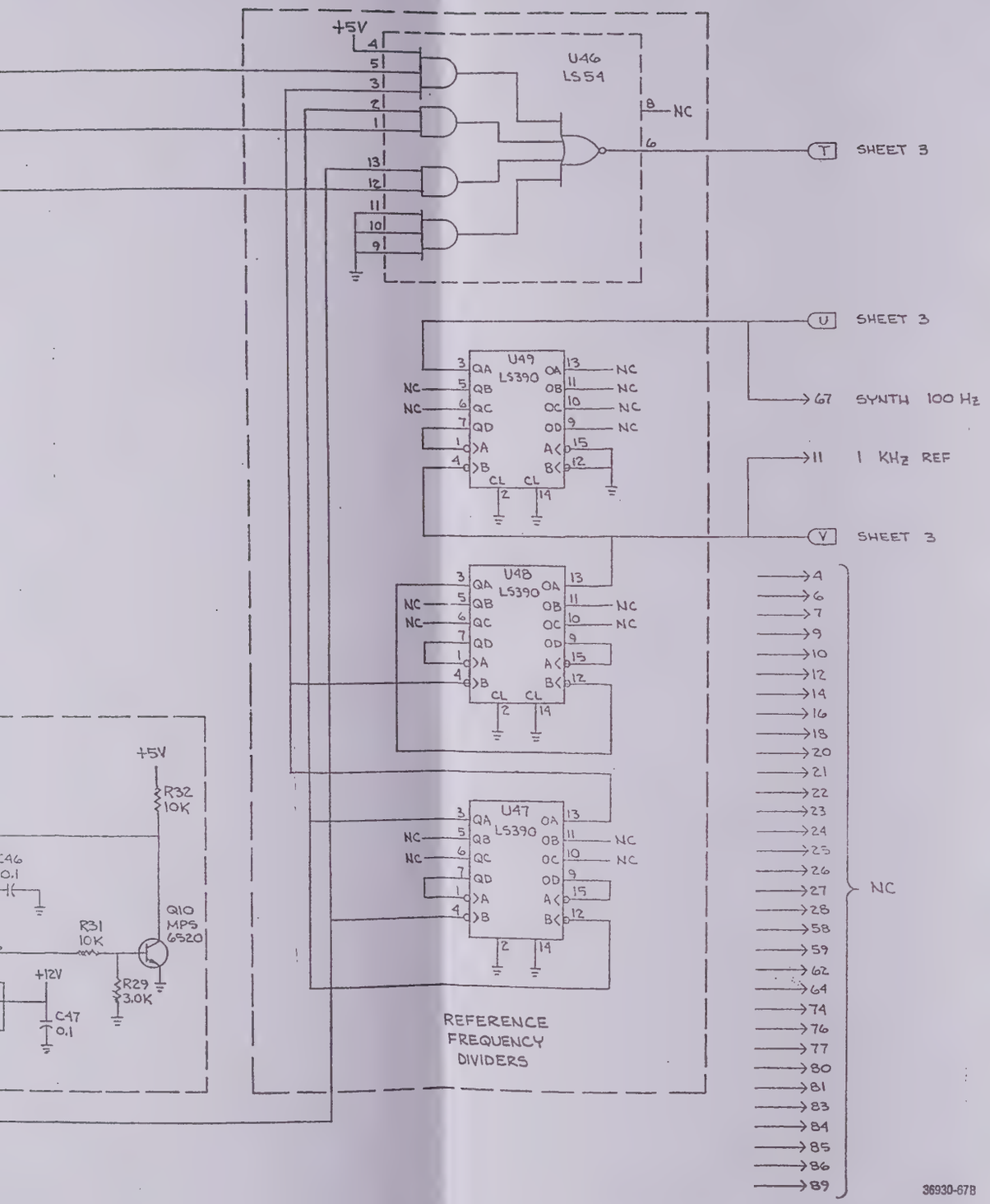
Figure 13-1. Block Diagram





WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

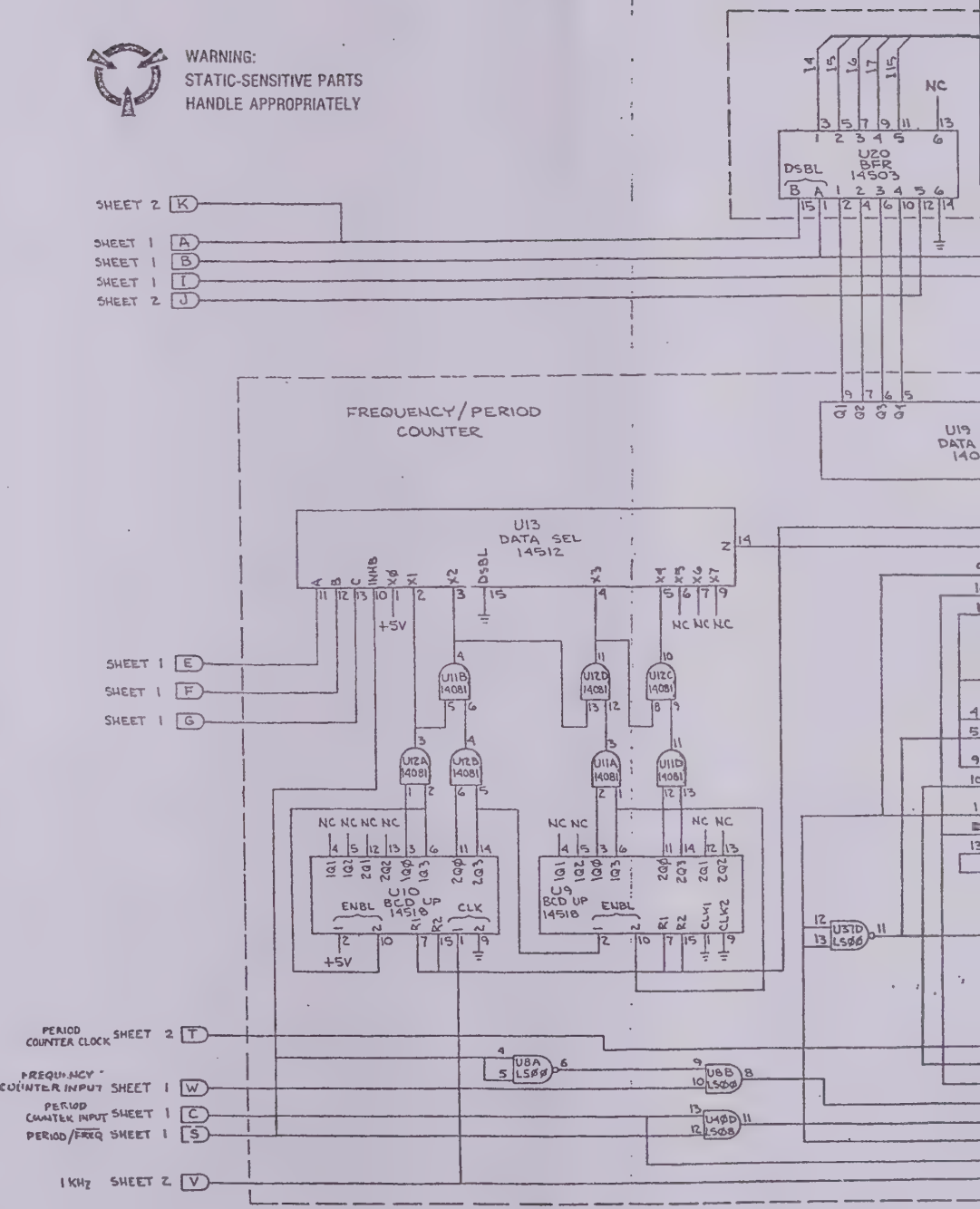
Figure 13-2b. Schematic (Shee



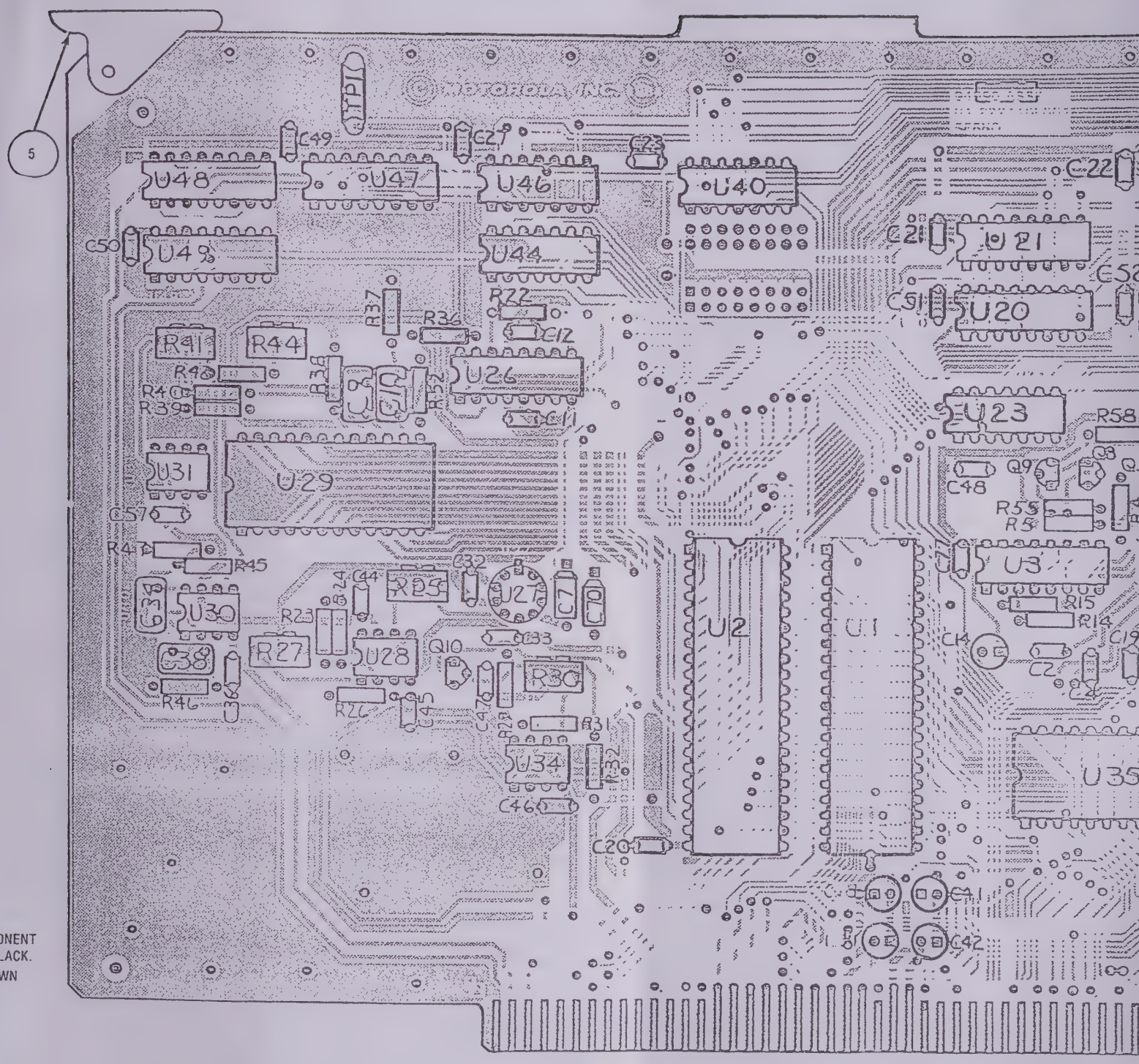
PROCESSOR INTERFACE BOARD (A11)

(RTC-1009A)

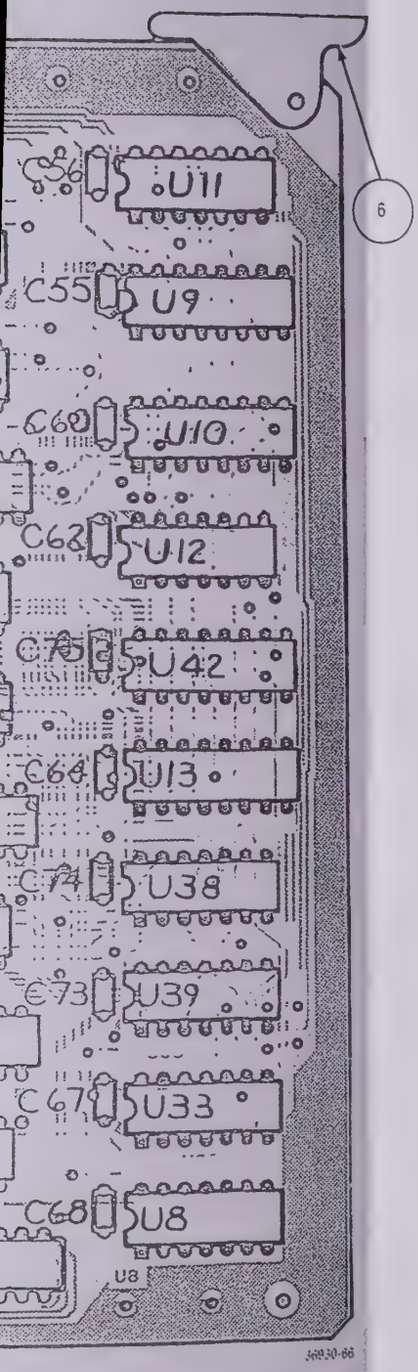
Figure 13-2c. Schematic (Sheet 3 of 3)



DUM/COUNTER BUFFERS
U22 BFR 14503
DSBL
U35 MC6840
TIMER
U18 CTR 197
U2 PIA 6821
U1 PIA 6821
U41 245
U16A 4027
U16B 4027
U15B LS74
U39B LS74
U15A LS74
U72 LS11
U8D LS08
U17B LS11
U23A LS86
U23B LS86
U23C LS86
U23D LS86
U44 LS27
U40B LS08
+5V
NC
AF DATA BUS (AD)
AF ADD BUS (AA)
RF BUS
NOT USED
OFFSET DATA
NOT USED
310-440 CNTL DATA
24 CNTL DATA
605 CNTL DATA
545 CNTL DATA
DATA LATCH
DATA CL
100 Hz
AF BUSS EN 2
SHEET 1
SHEET 2
36930-67 C



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE



Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
005	1	45-80339B28	CARD EJECTOR	
006	1	45-80339B30	CARD EJECTOR	MARKED
C 002	1	21-80342B10	CAPACITOR	.1UF-20-50
C 004	1	21-80342B10	CAPACITOR	.1UF-20-50
C 007	1	23-80341B02	CAPACITOR	2.2UF-20-20
C 009	1	21-80396A47	CAPACITOR	68PF-5-500
C 010	1	21-80339B22	CAPACITOR	270PF-5-300
C 011	1	21-80342B10	CAPACITOR	.1UF-20-50
C 012	1	21-80342B10	CAPACITOR	.1UF-20-50
C 014	1	23-80341B15	CAPACITOR	10UF-20-50
C 015	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	23-80341B15	CAPACITOR	10UF-20-50
C 019	1	21-80342B10	CAPACITOR	.1UF-20-50
C 020	1	21-80342B10	CAPACITOR	.1UF-20-50
C 021	1	21-80342B10	CAPACITOR	.1UF-20-50
C 022	1	21-80342B10	CAPACITOR	.1UF-20-50
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 027	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	23-80341B15	CAPACITOR	10UF-20-50
C 032	1	21-80342B10	CAPACITOR	.1UF-20-50
C 033	1	21-80342B10	CAPACITOR	.1UF-20-50
C 034	1	21-80369A89	CAPACITOR	27PF-5-500
C 036	1	21-80342B10	CAPACITOR	.1UF-20-50
C 038	1	21-80369A95	CAPACITOR	180PF-5-500
C 041	1	23-80341B15	CAPACITOR	10UF-20-50
C 042	1	23-80341B15	CAPACITOR	10UF-20-50
C 044	1	21-80342B10	CAPACITOR	.1UF-20-50
C 045	1	21-80342B10	CAPACITOR	.1UF-20-50
C 046	1	21-80342B10	CAPACITOR	.1UF-20-50
C 047	1	21-80342B10	CAPACITOR	.1UF-20-50
C 048	1	21-80342B10	CAPACITOR	.1UF-20-50
C 049	1	21-80342B10	CAPACITOR	.1UF-20-50
C 050	1	21-80342B10	CAPACITOR	.1UF-20-50
C 051	1	21-80342B10	CAPACITOR	.1UF-20-50
C 052	1	21-80342B10	CAPACITOR	.1UF-20-50
C 053	1	21-80342B10	CAPACITOR	.1UF-20-50
C 054	1	21-80342B10	CAPACITOR	.1UF-20-50
C 055	1	21-80342B10	CAPACITOR	.1UF-20-50
C 056	1	21-80342B10	CAPACITOR	.1UF-20-50
C 057	1	21-80342B10	CAPACITOR	.1UF-20-50
C 059	1	21-80342B10	CAPACITOR	.1UF-20-50
C 060	1	21-80342B10	CAPACITOR	.1UF-20-50
C 061	1	21-80342B10	CAPACITOR	.1UF-20-50
C 062	1	21-80342B10	CAPACITOR	.1UF-20-50
C 063	1	21-80342B10	CAPACITOR	.1UF-20-50
C 064	1	21-80342B10	CAPACITOR	.1UF-20-50
C 065	1	21-80342B10	CAPACITOR	.1UF-20-50
C 066	1	21-80342B10	CAPACITOR	.1UF-20-50
C 067	1	21-80342B10	CAPACITOR	.1UF-20-50
C 068	1	21-80342B10	CAPACITOR	.1UF-20-50
C 070	1	23-80341B02	CAPACITOR	2.2UF-20-20
C 071	1	21-80342B10	CAPACITOR	.1UF-20-50
C 072	1	21-80342B10	CAPACITOR	.1UF-20-50
C 073	1	21-80342B10	CAPACITOR	.1UF-20-50
C 074	1	21-80342B10	CAPACITOR	.1UF-20-50
C 075	1	21-80342B10	CAPACITOR	.1UF-20-50
C 076	1	21-80342B10	CAPACITOR	1UF-20-50
C 077	1	21-80342B10	CAPACITOR	.1UF-20-50
Q 004	1	48-80340B85	TRANSISTOR	MPS6519
Q 005	1	48-80340B85	TRANSISTOR	MPS6519
Q 008	1	48-80340B85	TRANSISTOR	MPS6519
Q 009	1	48-80340B85	TRANSISTOR	MPS6519
Q 010	1	48-80340B86	TRANSISTOR	MPS6520
R 001	1	06-11009C35	RESISTOR	270-5-1/4
R 002	1	06-11009C35	RESISTOR	270-5-1/4
R 004	1	06-11009C42	RESISTOR	510-5-1/4
R 005	1	06-11009C42	RESISTOR	510-5-1/4
R 011	1	06-11009C41	RESISTOR	470-5-1/4
R 012	1	06-11009C43	RESISTOR	560-5-1/4
R 013	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 014	1	06-11009C42	RESISTOR	510-5-1/4
R 015	1	06-11009C42	RESISTOR	510-5-1/4
R 022	1	06-80396A66	RESISTOR	249K-.5-1/8
R 023	1	06-80396A67	RESISTOR	3.32K-.5-1/8
R 024	1	06-80396A69	RESISTOR	7.5K-.5-1/8
R 025	1	18-83452F01	RESISTOR,VARIABLE	2K
R 026	1	06-11009D16	RESISTOR	560K-5-1/4
R 027	1	18-83452F15	RESISTOR,VARIABLE	20K
R 029	1	06-11009C60	RESISTOR	3K-5-1/4
R 030	1	18-83452F15	RESISTOR,VARIABLE	20K
R 031	1	06-11009C73	RESISTOR	10K-5-1/4

BOARD (ATT)

(RTC-1009A)

Figure 13-3. Printed Wiring Board Assembly and Parts List

SECTION 14.
PROCESSOR BOARD (A14) 01-P22240E001
PROCESSOR BOARD (A14) 01-P29050H001

PART 1. PROCESSOR BOARD 01-P22140E001

14.1 DESCRIPTION

The Processor board provides primary control and data manipulations for the System Analyzer. This board contains the microprocessor, program read-only memory (ROM), nonvolatile memory (NVM), random-access memory (RAM), peripheral-interface adapter (PIA), timing generator, and character generator. Input and output information is transferred through the (PIA) and the address, data, and control busses. The board uses a Motorola M6800-series microprocessor, 2K×8 of RAM, 1K×8 of NVM, and 24K×8 of paged ROM.

A block diagram of the Processor board is shown at the end of this section in Figure 14-2, a schematic in Figure 14-3, and the printed wiring board assembly and parts list in Figure 14-4.

14.2 THEORY OF OPERATION

14.2.1 MICROPROCESSOR

An M6809 microprocessor controls the System Analyzer's operating modes. The device has an 8-bit data bus, a 16-bit address bus, and a control bus which synchronizes data transfer and specialized processor functions. The microprocessor uses the 4-MHz crystal (Y1) to provide an operating frequency of 1 MHz on the E and Q lines.

14.2.2 MEMORY

14.2.2.1 Memory Access

To allow the microprocessor's 16-bit address to access more than 64K of memory, the memory is structured in pages, as shown in Figure 14-1. The pages are broken down into chip-select blocks. To select a page of memory, the processor uses two outputs (PB1 and PB2) from PIA U22. (See the A11 section, paragraph 13.2.1.1 for a description of the PIA.) These two signals work in conjunction with the address decoders (U23, U50, and U51) to select the proper memory device.

14.2.2.2 Program Read-Only Memory (ROM)

The program memory for the main System Analyzer is located on page 2 of the memory map. The

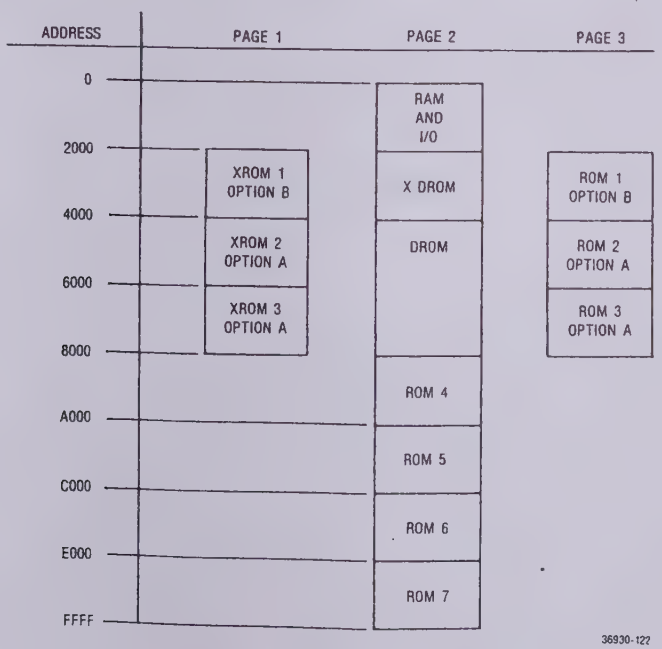


Figure 14-1. Memory Map

ROM consists of three 8192 × 8-bit and two 16,384 × 8-bit read-only memory devices. The program memory for the IEEE option (Option B) and the cellular mobile telephone option (Option A) is contained on pages 1 and 3. Option B uses a single 8192 × 8-bit ROM device, while Option A uses two 16,384 × 8-bit ROM devices.

14.2.2.3 Random-Access Memory (RAM)

The random-access memory provides temporary data storage for the processor and for the CRT alphanumeric display. The RAM for the main program and all options is located on page 2 of memory. The main program's RAM can store 1024 eight-bit words, of which 512 are used for the CRT display data. Option A has provisions for a 1024 × 8-bit RAM device.

14.2.2.4 Nonvolatile Memory (NVM)

The nonvolatile memory provides storage for 1024 8-bit words. Data that is to be held during power-off is held in the NVM, which consists of a battery-backed RAM. When the power is turned on, the microprocessor reads the NVM contents to obtain its start-up mode, the RF and tone-memory presets, and the remainder of the preset data. If the operator changes a preset, the microprocessor changes the data in the NVM to remember the new preset.

14.2.3 INPUT/OUTPUT

Peripheral-interface adapters provide input and output latches for external data to and from the processor. The PIA on this board (U22) provides for nine inputs from the keyboard, four column inputs (COL 0-3), and five row inputs (ROW 0-4). When the two inputs OPT A DET and OPT B DET are pulled low, they signal the processor that the Option A or Option B boards are installed. Another input (OPTO DIR) provides the processor with the optical encoder's direction of rotation. Two outputs, PB0 and PB1, select the memory page.

14.2.4 CHARACTER DISPLAY

14.2.4.1 General

Characters are displayed on the CRT as 8-by-8 dot matrices. Thirty-two dot matrices, of which the last two are always blank, make one character line. Sixteen character lines, of which the last one is always blank, make a display frame. Thus, the total number of matrices available for character display is 30 × 15 or 450. The two blank matrices and the blank line are used for horizontal and vertical retrace blanking, respectively. The display is generated by dot rows. As the CRT sweeps the first dot row of a character line, the character generator outputs a serial-bit pattern of 1's and 0's that turns the CRT intensity on and off. The result is a row of dots that, when combined with the next seven rows, forms a character.

The frame display is stored at U27 in 32 × 16 bytes of RAM; this RAM is shared by the character generator and the processor. The two are synchronized to access the RAM during alternate half cycles of the master E clock. The RAM multiplexer (U24-U26) allows both the processor and the character generator to have non-interference access to the RAM every other 0.5 microsecond. In RAM, the processor stores an 8-bit word representing the character to be displayed.

14.2.4.2 Timing Generator

The timing generator provides timing signals for the character generator. All the timing signals are synchronized to the 1-MHz E clock from the microprocessor. The E and Q clocks are exclusive-OR'd to provide a 2-MHz signal which is used to clock the 8-bit shift register (U13). This clock signal provides the dot rate. The 1-MHz E clock is divided-by-four by U19, and the resulting signal is used to latch one dot-matrix row into U11. This provides a dot-matrix rate of 250 kHz. The divided-by-four signal is further divided by a 12-bit binary counter (U10 and U15), to provide a row rate of 7812.5 Hz, a character line rate of 976.5 Hz, and a frame rate of 61.04 Hz.

14.2.4.3 Character Generator

The character generator simultaneously scans the RAM in sequence with the CRT display scan. The signals for the CRT display scan come from the horizontal and vertical character-sweep generators on the Scope Amplifier board (A7). The 12-bit binary counter provides the 9 bits of information stored in RAM. As each location in RAM is addressed, the 8-bit word stored at that location is latched into the 8-bit latch (U11) at the dot-matrix rate of 250 kHz. Seven of the bits are held in the latch and are applied to the character ROM (U12); the remaining bit is not used. An additional 3 bits from the 12-bit binary counter tell which row of dots is being scanned. Thus, the 10 bits being applied to the character ROM define a particular dot row of a particular character. The 8-bit pattern that defines this dot row is then available at the output of the character ROM. This output is parallel-loaded into the 8-bit shift register, U13. The 8 bits are serially shifted out on the CHAR GEN Z-AXIS line at a dot rate of 2 MHz. The 12-bit binary counter also provides synchronizing signals for the character-sweep generators on the A7 board. The horizontal and vertical character-sweep generators are reset and started by one-shots U34A and U34B, respectively. The horizontal one-shot enable is located at the end of a dot row. The vertical one-shot enable has two sources: the $\overline{\text{CHAR GEN RESET}}$ line for dual-display mode, and the 12-bit binary counter end-of-frame for character display. Also provided is a signal $\overline{\text{LINE 1}}$ which signals the dual-display control on the Scope/DVM Control board that the first character line has been traced.

14.3 DESCRIPTION

The Processor board provides primary control and data manipulations for the system analyzer, and contains the following:

- microprocessor
- program read only memory (ROM)
- nonvolatile memory (NVM)
- random access memory (RAM)
- peripheral-interface adapter (PIA)
- printer circuitry
- dual tone multifrequency (DTMF) encoder/decoder
- timing generator
- character generator

Input and output information is transferred through the PIA and the address, data, and control buses.

A block diagram of the Processor board is shown at the end of this section in Figure 14-5, a schematic in Figure 14-6, and the printed wiring board assembly and parts list in Figure 14-7.

14.4 THEORY OF OPERATION

14.4.1 MICROPROCESSOR

An M6809 microprocessor controls the system analyzer's operating modes. The device has an 8-bit data bus, a 16-bit address bus, and a control bus which synchronizes data transfer and specialized processor functions. The microprocessor uses a 4-MHz crystal (Y1) to provide an operating frequency of 1 MHz on the E and Q lines.

14.4.2 MEMORY

14.4.2.1 Memory Access

To allow the microprocessor's 16-bit address bus to access more than 64K of memory, the memory is structured in pages, as shown in Figure 14-2 The pages are broken down into chip-select blocks. To select a page of memory, the processor uses 4 outputs (PB0, PB1, PB2, and PB3) from PIA U38. (See section 13, A11 for a description of PIAs.) These signals work in conjunction with the address decoders (U7 and U8) to select the proper memory device.

14.4.2.2 Program Read Only Memory (ROM)

The Processor Board's program memory is located in the unpaged area of the memory map, page 2 and page 4. The ROM consists of three 32K × 8-bit read-only memory devices. The program memory for the options is on the pages shown in Figure 14-2.

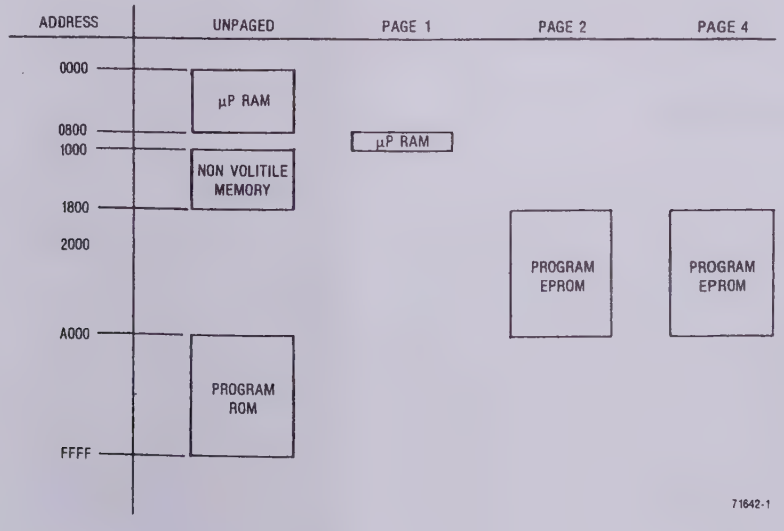


Figure 14-2. Memory Map

14.4.2.3 Random Access Memory (RAM)

The random access memory provides temporary data storage for the processor and for the CRT alphanumeric display. RAM is partitioned into unpaged, processor paged, and option paged RAM. The unpaged RAM can store 2048 8-bit words, of which 512 are used for the CRT display data. The unpaged RAM is located from 000 to 7FF hex. Each paged RAM can store 2048 8-bit words and is located from 800 to FFF hex. The processor paged RAM is enabled by pulling output PB4 of U38 low. Pulling this output high causes XRAM to go low when a valid address occurs, enabling option paged RAM. To prevent more than one option RAM from being enabled, each option has another enable line that must be set.

14.4.2.4 Nonvolatile Memory (NVM)

The nonvolatile memory provides storage for 2048 8-bit words. Data that is to be held during power-off is held in the NVM, which consists of a battery-backed RAM. When the power is turned on, the microprocessor reads the NVM contents to obtain its start-up mode, the RF and tone-memory presets, and the remainder of the preset data. If the operator changes a preset, the microprocessor changes the data in the NVM to reflect the new preset.

14.4.3 INPUT/OUTPUT

Peripheral Interface Adapters provide input and output latches for external data to and from the processor. One of the PIAs on this board (U39) provides for nine inputs from the keyboard: five row inputs (ROW 0-4), and four column inputs (COL 0-3). OPT A DET and OPT B DET are outputs which enable the program memory for the A and B slot, respectively. Another input (OPTO DIR) provides the processor with the optical encoder's direction of rotation.

14.4.4 CHARACTER DISPLAY

14.4.4.1 General

Characters are displayed on the CRT as 8×8 dot matrices. One character line is composed of 32 dot matrices, of which the last two are always blank. A display frame is composed of 16 character lines, of which the last one is always blank. Thus, the total number of matrices available for character display is 30×15 or 450. The two blank matrices and the blank line are used for horizontal and vertical retrace blanking, respectively. The display is generated by dot rows. As the CRT sweeps the first dot row of a character line, the character generator outputs a serial-bit pattern of 1s and 0s that turns the CRT intensity on and off. The result is a row of dots, which combined with the next seven rows, forms a character.

The frame display is stored at U26, in 32×16 bytes of RAM. This RAM is shared by the character generator and the processor. The two are synchronized to access the RAM during alternate half cycles of the master E clock. The RAM multiplexer (U28-U30) allows both the processor and the character generator to have non-interference access to the RAM every other 0.5 microsecond. In RAM, the processor stores an 8-bit word representing the character to be displayed.

14.4.4.2 Timing Generator

The timing generator provides timing signals for the character generator. All the timing signals are synchronized to the 1-MHz E clock from the microprocessor. The E and Q clocks are exclusive-OR'd to provide a 2-MHz signal which is used to clock the 8-bit shift register (U1). This clock signal provides the dot rate. The 1-MHz E clock is divided-by-four by U10, and the resulting signal is used to latch one dot-matrix row into U3. This provides a dot-matrix rate of 250 kHz. The divided-by-four signal is further divided by a 12-bit binary counter (U24 and U25), to provide a row rate of 7812.5 Hz, a character line rate of 976.5 Hz, and a frame rate of 61.04 Hz.

14.4.4.3 Character Generator

The character generator simultaneously scans the RAM in sequence with the CRT display scan. The signals for the CRT display scan come from the horizontal and vertical character-sweep generators on the Scope Amplifier board (A7). The 12-bit binary counter provides the 9 bits of information stored in RAM. As each location in RAM is addressed, the 8-bit word stored at the location is latched into the 8-bit latch (U3) at the dot-matrix rate of 250 kHz. Seven of the bits are held in the latch and are applied to the character ROM (U2); the remaining bit is not used. An additional 3 bits from the 12-bit binary counter tells which row of dots is being scanned. Thus, the 10 bits being applied to the character ROM define a particular dot row of a particular character. The 8-bit pattern that defines this dot row is then available at the output of the character ROM. This output is parallel-loaded into the 8-bit shift register, U1. The 8 bits are serially shifted out on the CHAR GEN Z-AXIS line at a dot rate of 2 MHz. The 12-bit binary counter also provides synchronizing signals for the character-sweep generators on the A7 board. The horizontal and vertical character-sweep generators are reset and started by one-shots (U22A and U22B respectively). The horizontal one-shot enable is located at the end of a dot row. The vertical one-shot enable has two sources: the CHAR GEN RESET line for dual-display mode, and

the 12-bit binary counter end-of-frame for character display. Also provided is signal LINE 1 which signals the dual-display control on the Scope/DVM Control board that the first character line has been traced.

14.4.5 DTMF ENCODE/DECODE

ICs U36 and U37 contain all circuitry necessary to encode and decode dual tone multi frequency (DTMF) signals.

The processor uses four outputs (PA4 – PA7) from PIA U38 to instruct the DTMF encoder which tones to generate. When control line CB2 of PIA U38 is brought to a logic 1, the selected DTMF tone is transmitted.

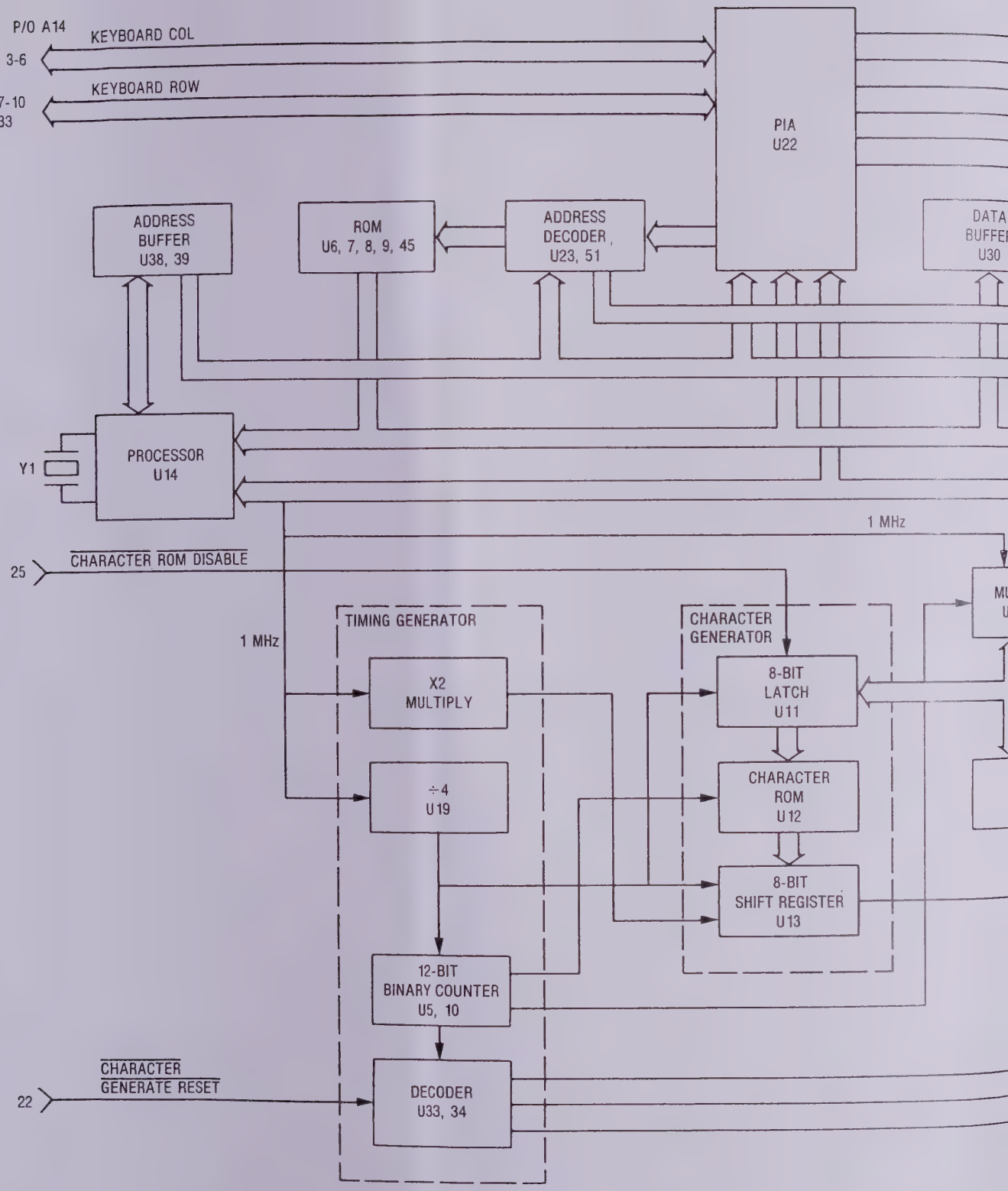
Incoming DTMF signals appear at the decoder via the VERT FROM RNG SW line. Each received tone must have an amplitude of 19.5 to 615 mV rms with a minimum duration of 40 ms. Consecutive DTMF tones must be separated by at least 40 ms. The difference between high and low level tones must not exceed +10 dB.

After a valid tone has been received and decoded, U37 outputs a hexadecimal number representing the decoded signal, and brings the STROBE output to a logic 1. PIA U38 then reads the hexadecimal number and clears U37 by applying a logic 1 to its CLEAR line.

14.4.6 PRINTER PORT

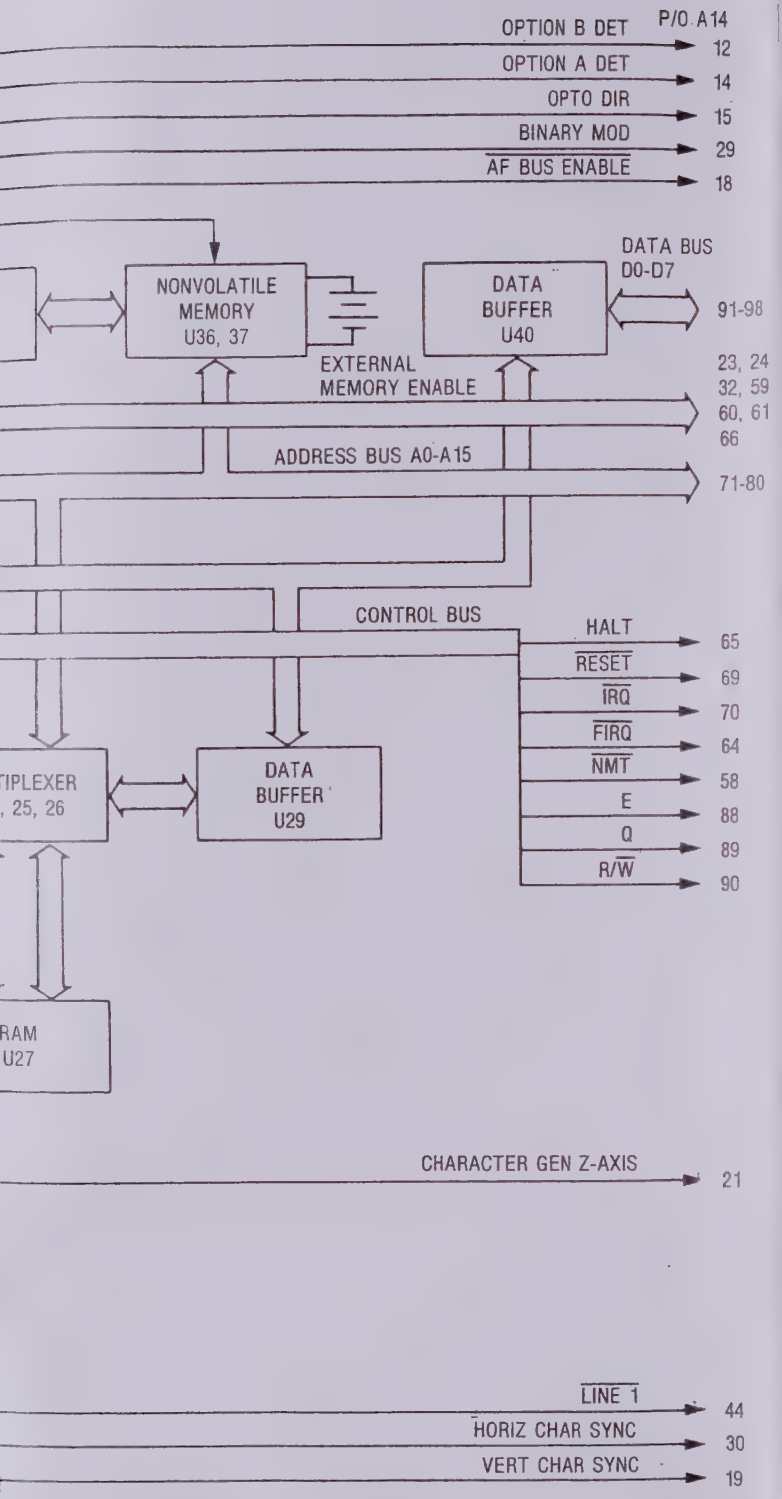
U44 contains the circuitry to output data to a printer in accordance with the RS-232 standard protocol.

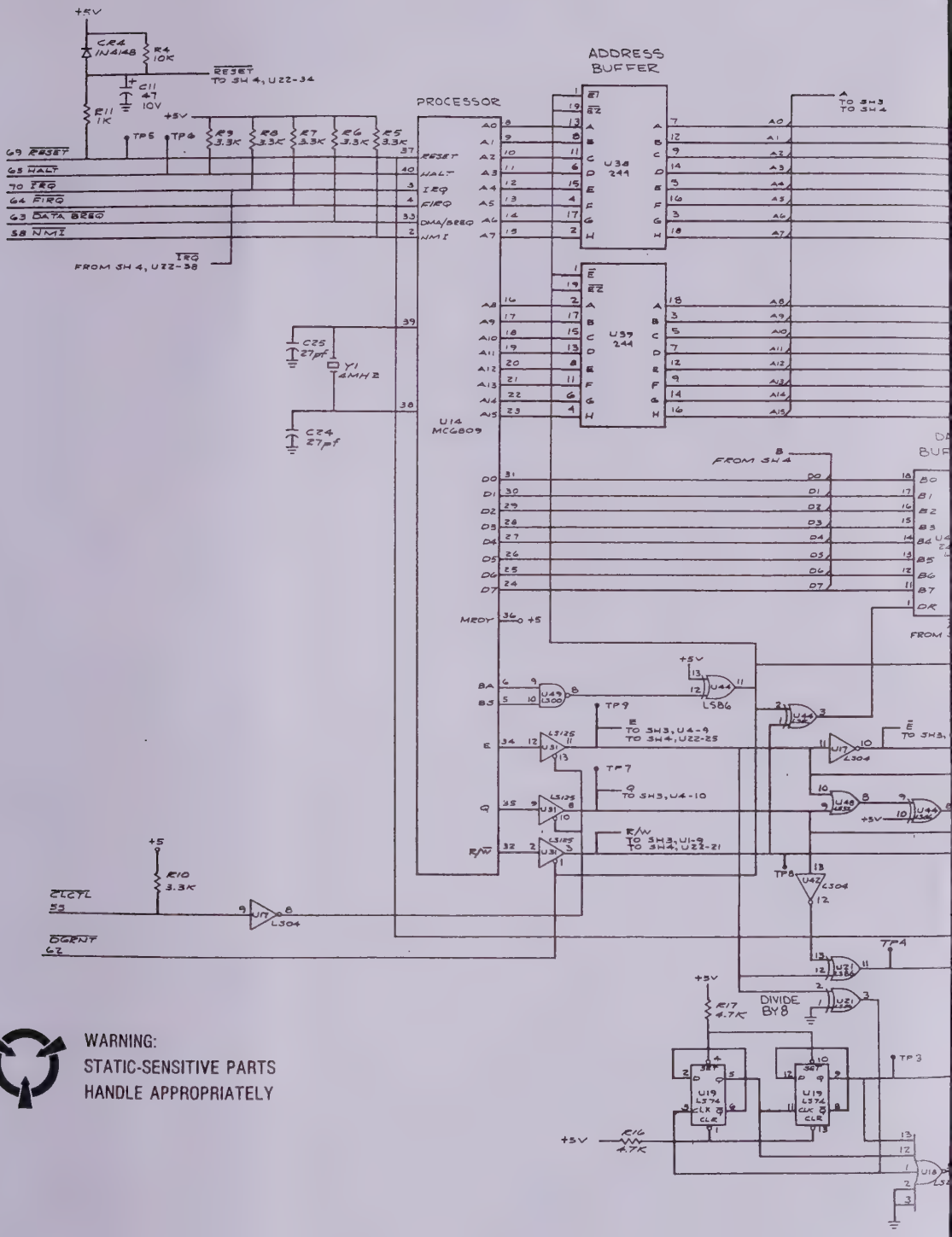
The processor transfers data to U44, where it is converted from parallel to serial format. U35 then converts the serial data from TTL levels to bipolar levels (+5 V/−5 V), as long as a logic 0 appears on pin 16 of U44.


P/O A14
KEYBOARD COL
3-6
KEYBOARD ROW
7-10
33
PIA
U22
ADDRESS
BUFFER
U38, 39
ROM
U6, 7, 8, 9, 45
ADDRESS
DECODER
U23, 51
DATA
BUFFER
U30
Y1
PROCESSOR
U14
1 MHz
25
CHARACTER ROM DISABLE
TIMING GENERATOR
1 MHz
X2
MULTIPLY
÷4
U19
12-BIT
BINARY COUNTER
U5, 10
CHARACTER
GENERATOR
8-BIT
LATCH
U11
CHARACTER
ROM
U12
8-BIT
SHIFT REGISTER
U13
22
CHARACTER
GENERATE RESET
DECODER
U33, 34

(RTC-1010A) 01-P22140E001

Figure 14-3. Block Diagram



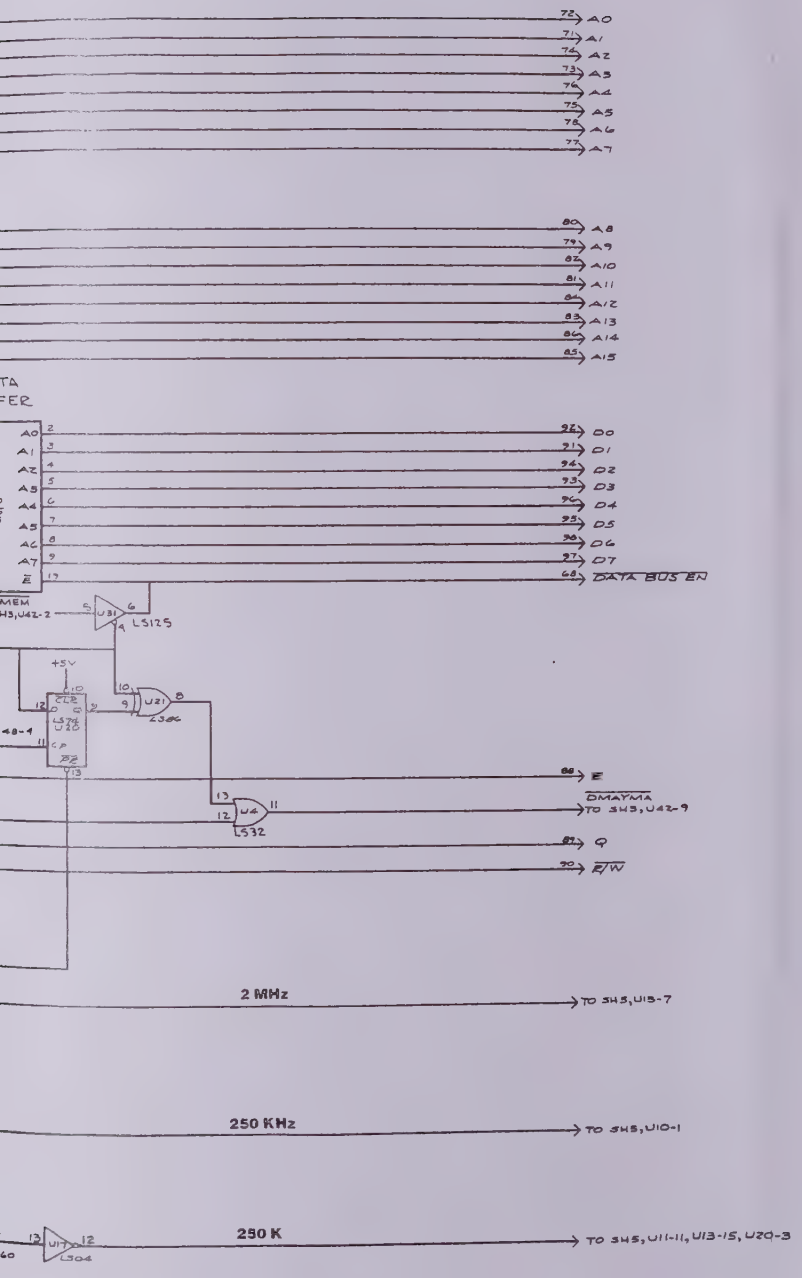


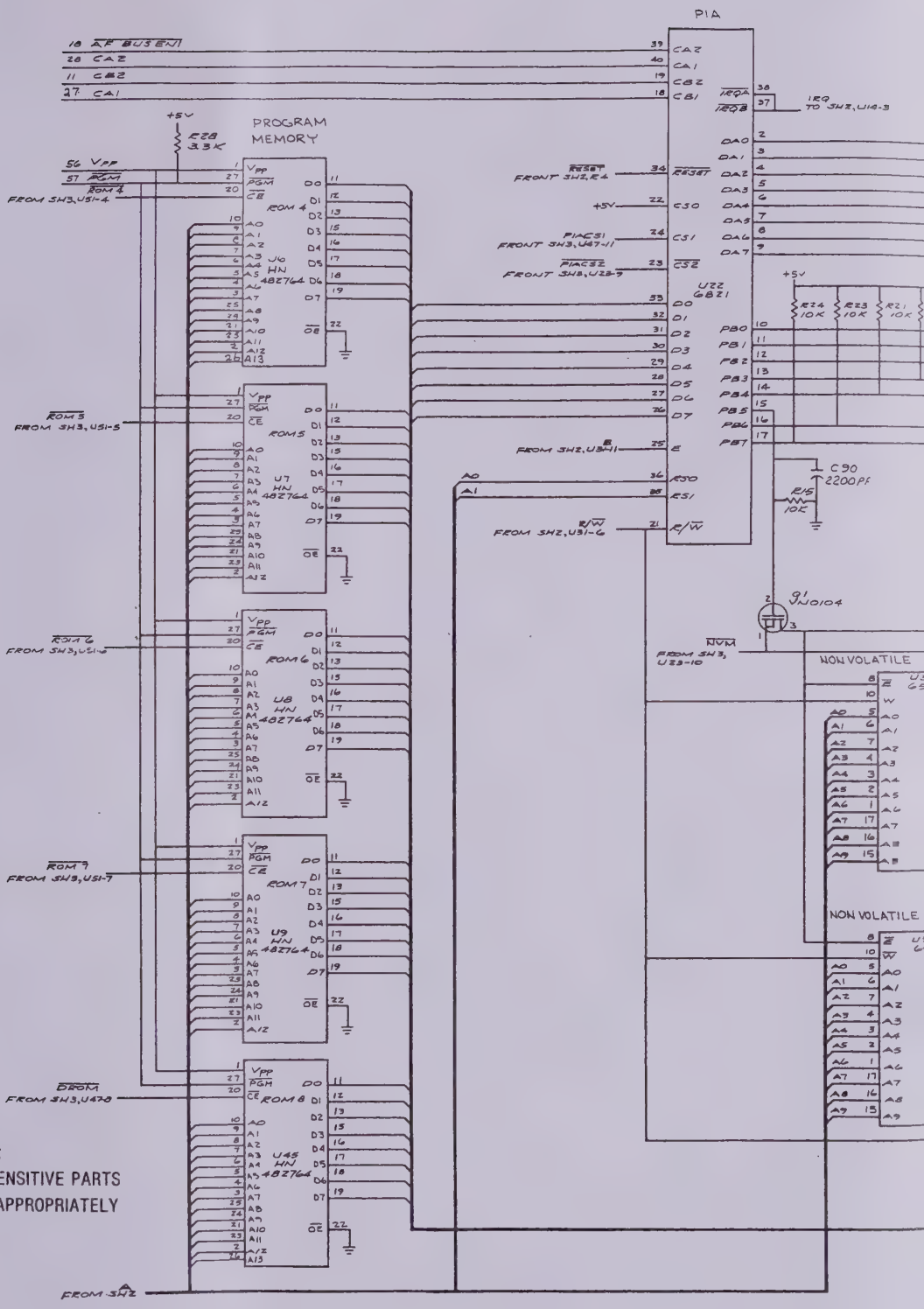
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

PROCESSOR BOARD (A14)

(RTC-1010A) 01-P22140E001

Figure 14-4b. Schematic (sheet 2 of 5)



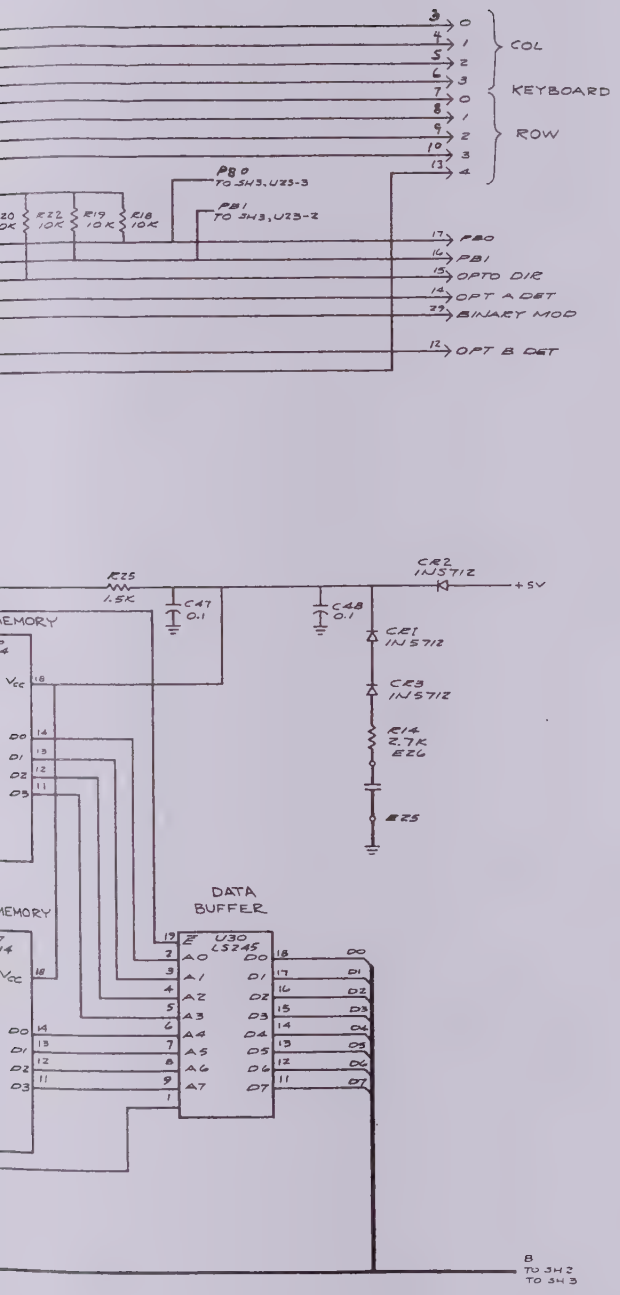


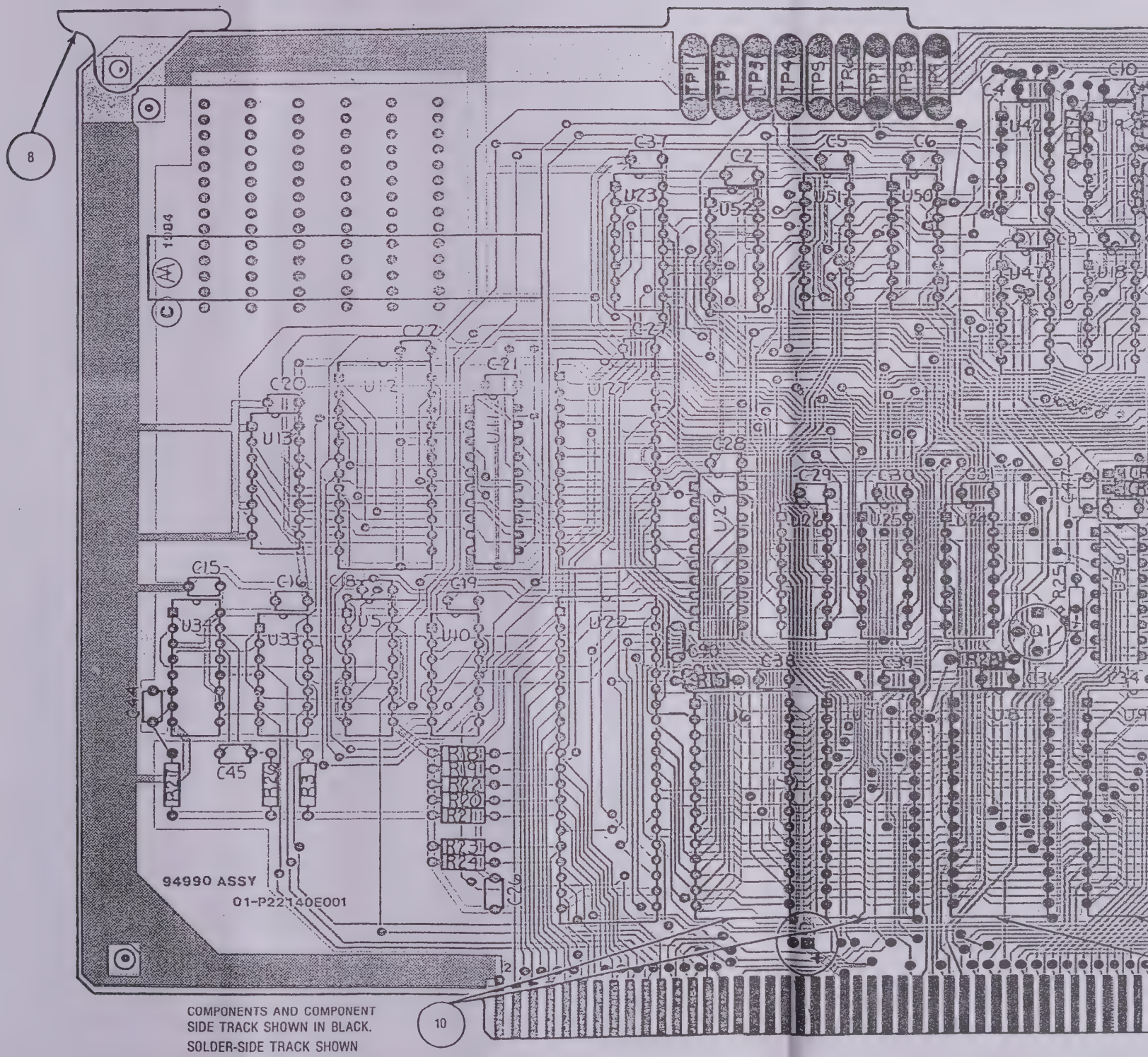
WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

PROCESSOR BOARD (A14)

(RTC-1010A) 01-P22140E001

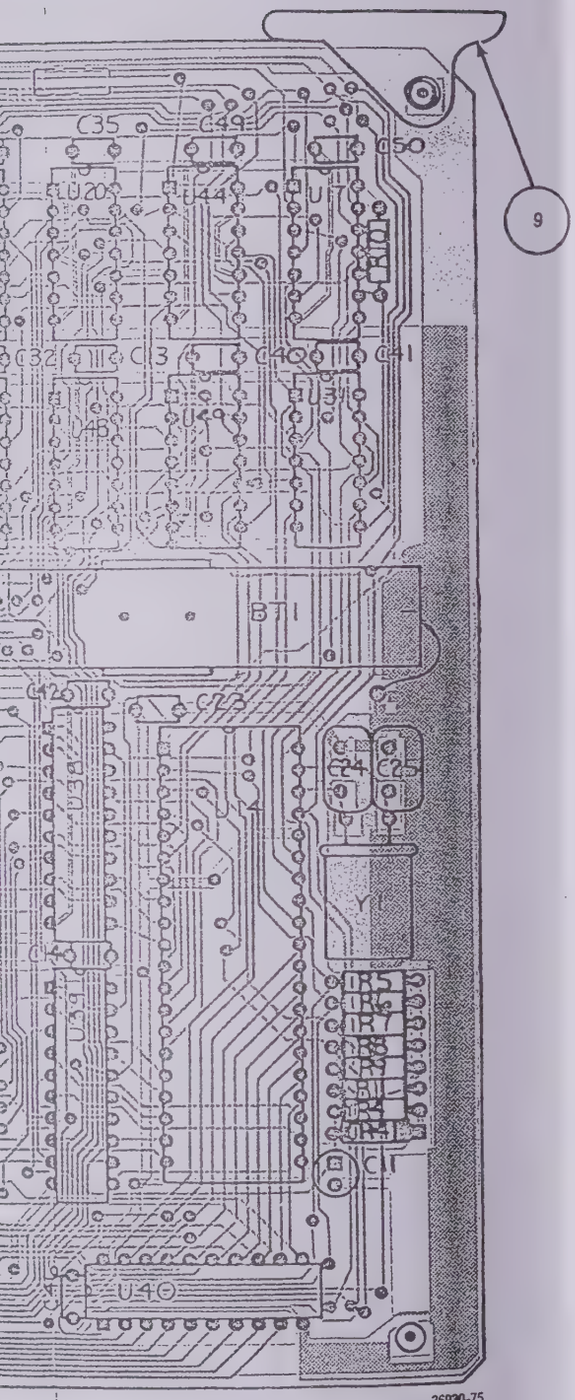
Figure 14-4d. Schematic (sheet 4 of 5)





COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.

SOLDER-SIDE TRACK SHOWN IN ORANGE

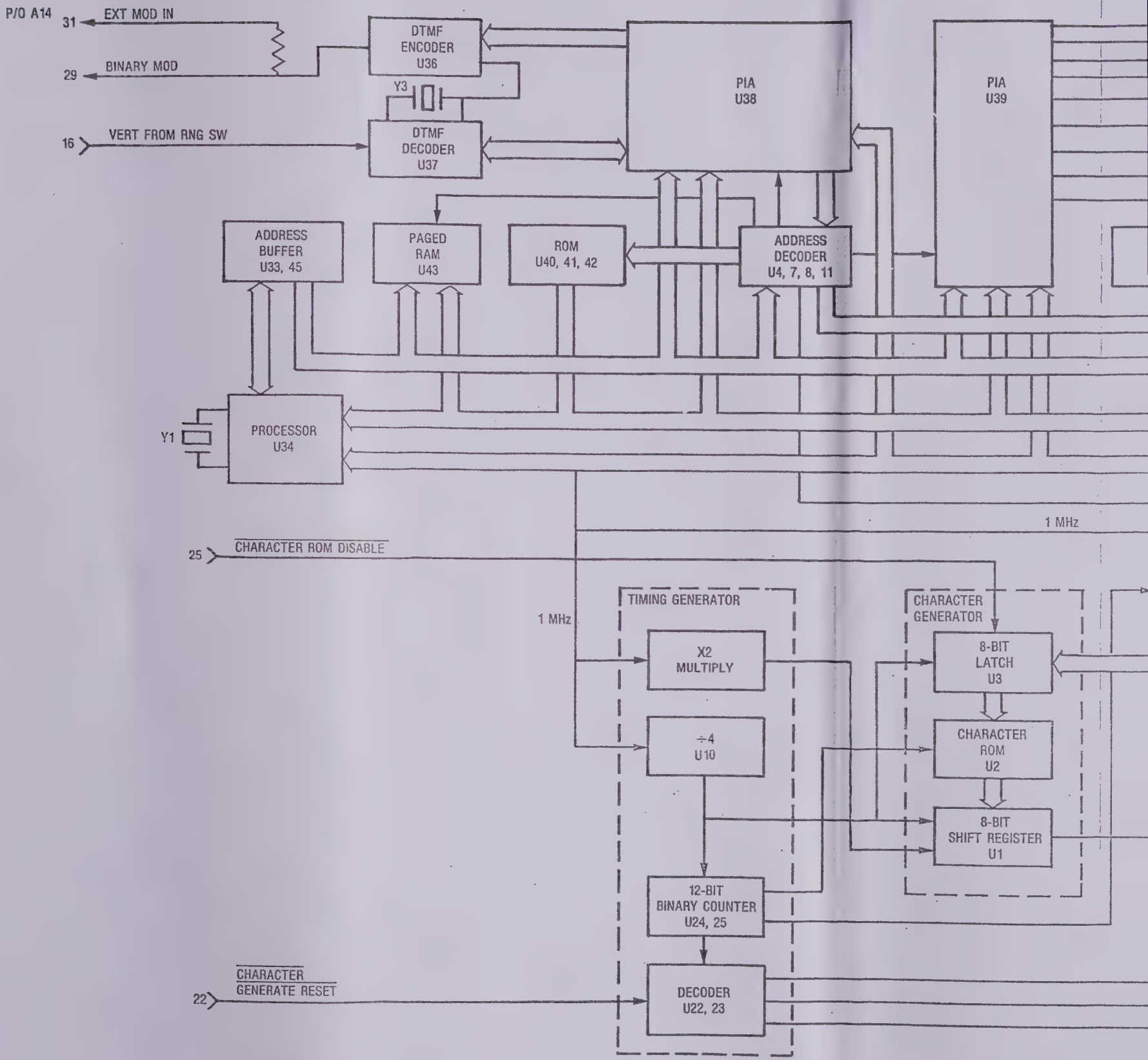


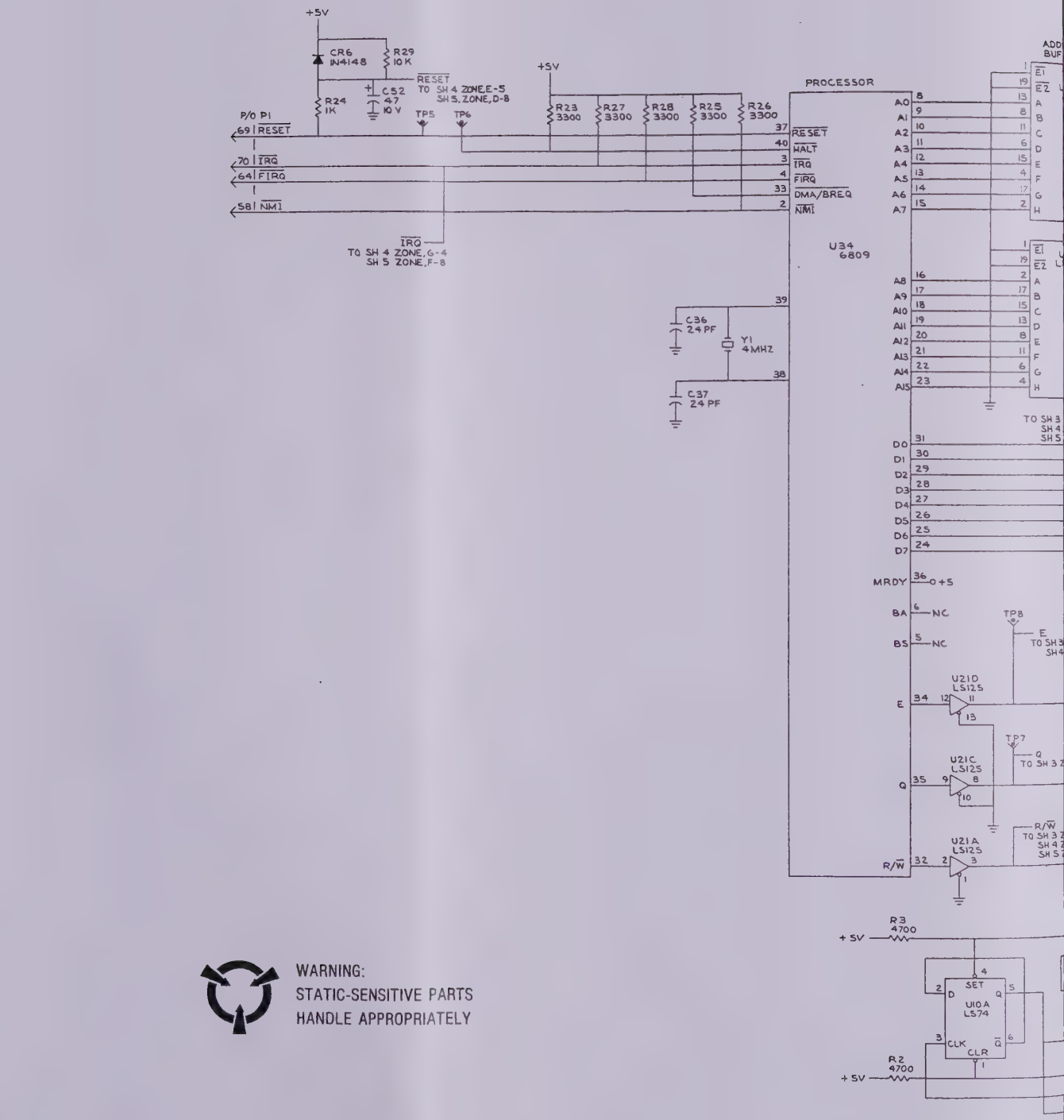
PROCESSOR BOARD (A14)
RTC-1010A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
008	1	45-80339B28	CARD EJECTOR	
009	1	45-80339B33	CARD EJECTOR	MARKED
010	5	09-80339B81	SOCKET	28 PIN
BT001	1	60-80396A01	BATTERY,LITHIUM-MANGANESE	3V
C 001	1	23-80341B15	CAPACITOR	10UF-20-50
C 002	1	21-80342B10	CAPACITOR	.1UF-20-50
C 003	1	21-80342B10	CAPACITOR	.1UF-20-50
C 004	1	21-80342B10	CAPACITOR	.1UF-20-50
C 005	1	21-80342B10	CAPACITOR	.1UF-20-50
C 006	1	21-80342B10	CAPACITOR	.1UF-20-50
C 007	1	21-00850118	CAPACITOR	100PF-5-500
C 008	1	21-80342B10	CAPACITOR	.1UF-20-50
C 009	1	21-80342B10	CAPACITOR	.1UF-20-50
C 010	1	21-80342B10	CAPACITOR	.1UF-20-50
C 011	1	23-84665F25	CAPACITOR	47UF-20-10
C 012	1	21-80342B10	CAPACITOR	.1UF-20-50
C 013	1	21-80342B10	CAPACITOR	.1UF-20-50
C 014	1	21-80342B10	CAPACITOR	.1UF-20-50
C 015	1	21-80342B10	CAPACITOR	.1UF-20-50
C 016	1	21-80342B10	CAPACITOR	.1UF-20-50
C 017	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	21-80342B10	CAPACITOR	.1UF-20-50
C 019	1	21-80342B10	CAPACITOR	.1UF-20-50
C 020	1	21-80342B10	CAPACITOR	.1UF-20-50
C 021	1	21-80342B10	CAPACITOR	.1UF-20-50
C 022	1	21-80342B10	CAPACITOR	.1UF-20-50
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 024	1	21-80339B14	CAPACITOR	24PF-5-500
C 025	1	21-80339B14	CAPACITOR	24PF-5-500
C 026	1	21-80342B10	CAPACITOR	.1UF-20-50
C 027	1	21-80342B10	CAPACITOR	.1UF-20-50
C 028	1	21-80342B10	CAPACITOR	.1UF-20-50
C 029	1	21-80342B10	CAPACITOR	.1UF-20-50
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	21-80342B10	CAPACITOR	.1UF-20-50
C 032	1	21-80342B10	CAPACITOR	.1UF-20-50
C 033	1	21-80342B10	CAPACITOR	.1UF-20-50
C 034	1	21-80342B10	CAPACITOR	.1UF-20-50
C 035	1	21-80342B10	CAPACITOR	.1UF-20-50
C 036	1	21-80342B10	CAPACITOR	.1UF-20-50
C 037	1	21-80342B10	CAPACITOR	.1UF-20-50
C 038	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	21-80342B10	CAPACITOR	.1UF-20-50
C 040	1	21-80342B10	CAPACITOR	.1UF-20-50
C 041	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	21-80342B10	CAPACITOR	.1UF-20-50
C 043	1	21-80342B10	CAPACITOR	.1UF-20-50
C 044	1	21-80341B93	CAPACITOR	1000PF-20-100
C 045	1	21-80341B97	CAPACITOR	.1UF-20-100
C 046	1	21-80342B10	CAPACITOR	.1UF-20-50
C 047	1	21-80342B10	CAPACITOR	.1UF-20-50
C 048	1	21-80342B10	CAPACITOR	.1UF-20-50
C 049	1	21-80342B10	CAPACITOR	.1UF-20-50
C 050	1	21-80342B10	CAPACITOR	.1UF-20-50
C 090	1	21-80341B99	CAPACITOR	2200PF-20-100
CR001	1	48-80396A27	DIODE	
CR002	1	48-80396A27	DIODE	
CR003	1	48-80396A27	DIODE	
CR004	1	48-84463K02	DIODE	
Q 001	1	48-80341B22	TRANSISTOR	
R 001	1	06-10621C39	RESISTOR	2.87K-1-1/4
R 002	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 003	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 004	1	06-11009C73	RESISTOR	10K-5-1/4
R 005	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 006	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 007	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 008	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 009	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 010	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 011	1	06-11009C49	RESISTOR	1K-5-1/4
R 014	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 015	1	06-11009C73	RESISTOR	10K-5-1/4
R 016	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 017	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 018	1	06-11009C73	RESISTOR	10K-5-1/4
R 019	1	06-11009C73	RESISTOR	10K-5-1/4
R 020	1	06-11009C73	RESISTOR	10K-5-1/4
R 021	1	06-11009C73	RESISTOR	10K-5-1/4
R 022	1	06-11009C73	RESISTOR	10K-5-1/4
R 023	1	06-11009C73	RESISTOR	10K-5-1/4
R 024	1	06-11009C73	RESISTOR	10K-5-1/4
R 025	1	06-11009C53	RESISTORS	1.5K-5-1/4

PROCESSOR BOARD (A14)
(RTC-1010A) 01-P22140E001

Figure 14-5. Printed Wiring Board Assem and Parts List


P/O A14
31
EXT MOD IN
29
BINARY MOD
16
VERT FROM RNG SW
DTMF ENCODER U36
Y3
DTMF DECODER U37
PIA U38
PIA U39
ADDRESS BUFFER U33, 45
PAGED RAM U43
ROM U40, 41, 42
ADDRESS DECODER U4, 7, 8, 11
Y1
PROCESSOR U34
1 MHz
25
CHARACTER ROM DISABLE
TIMING GENERATOR
1 MHz
X2 MULTIPLY
÷4 U10
12-BIT BINARY COUNTER U24, 25
DECODER U22, 23
CHARACTER GENERATOR
8-BIT LATCH U3
CHARACTER ROM U2
8-BIT SHIFT REGISTER U1
22
CHARACTER GENERATE RESET

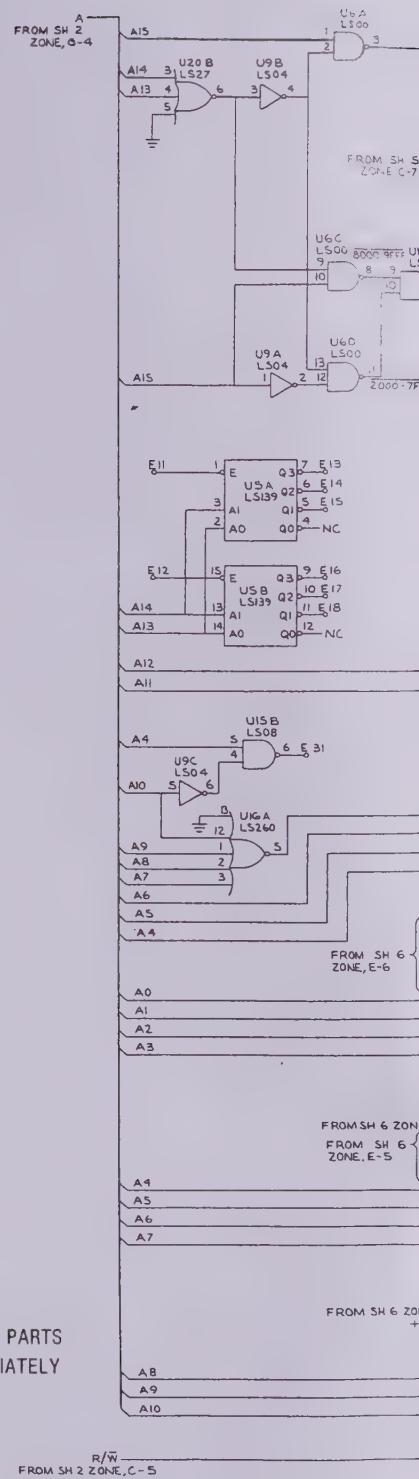


WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

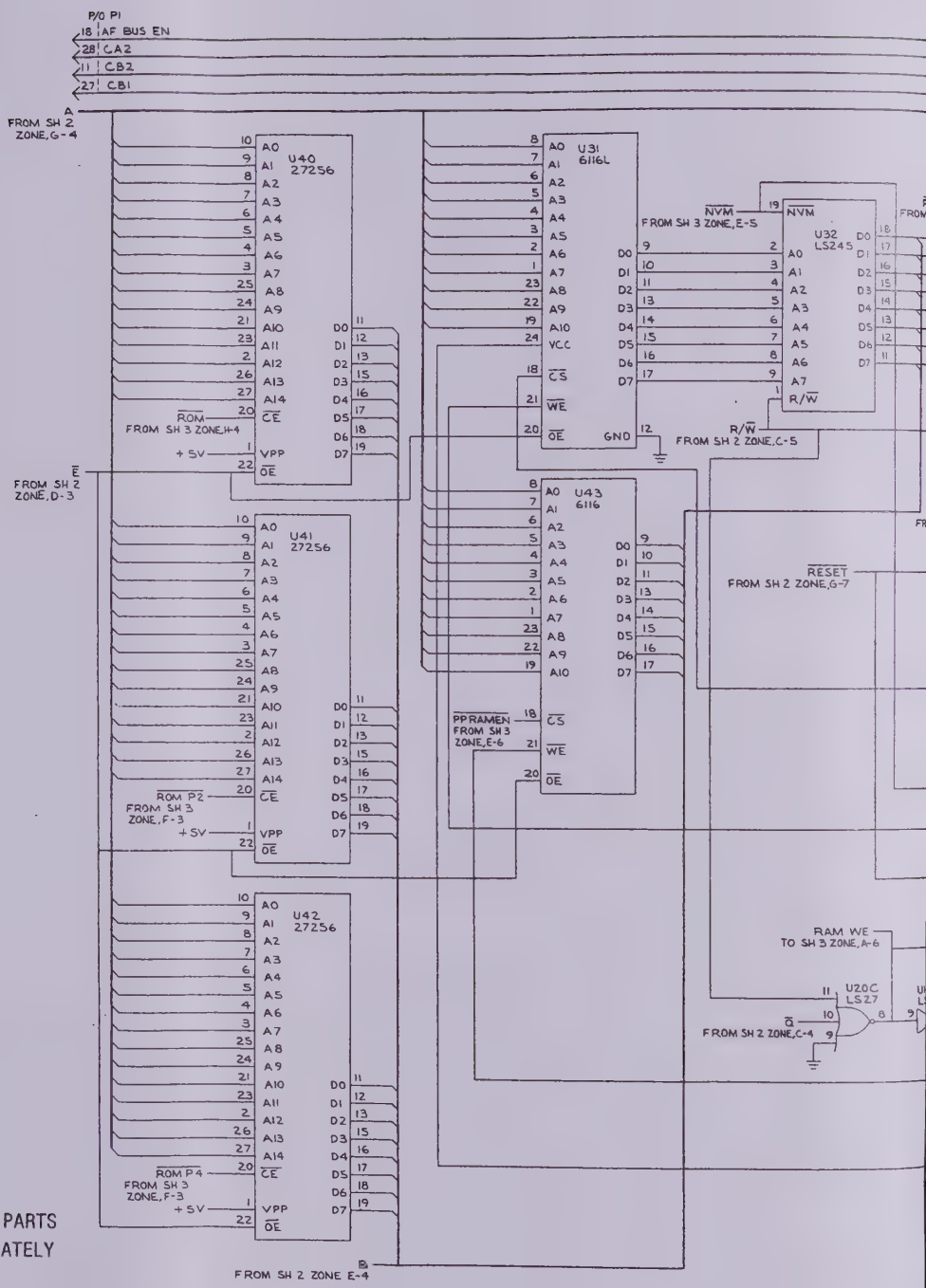
PROCESSOR BOARD (A14)

(RTC-1010A) 01-P29050H001

Figure 14-7c. Schematic (sheet 3 of 6)



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

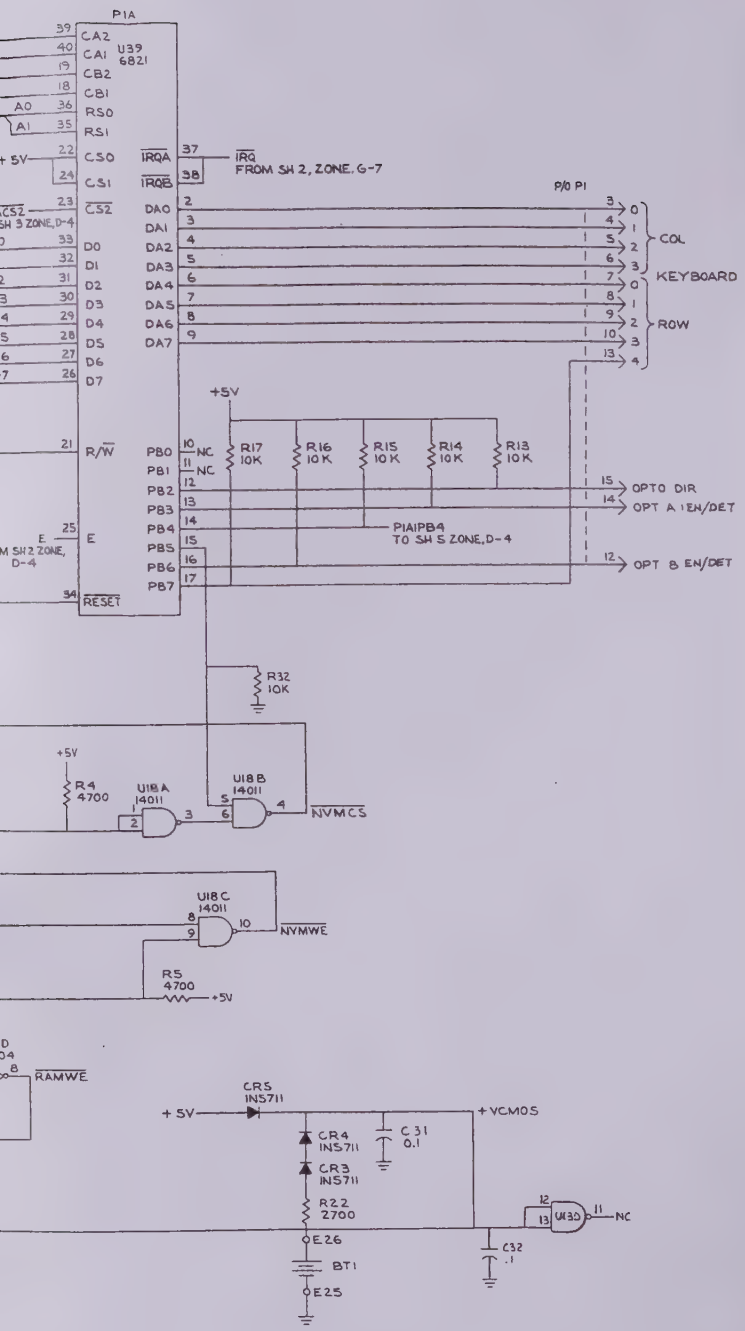


WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

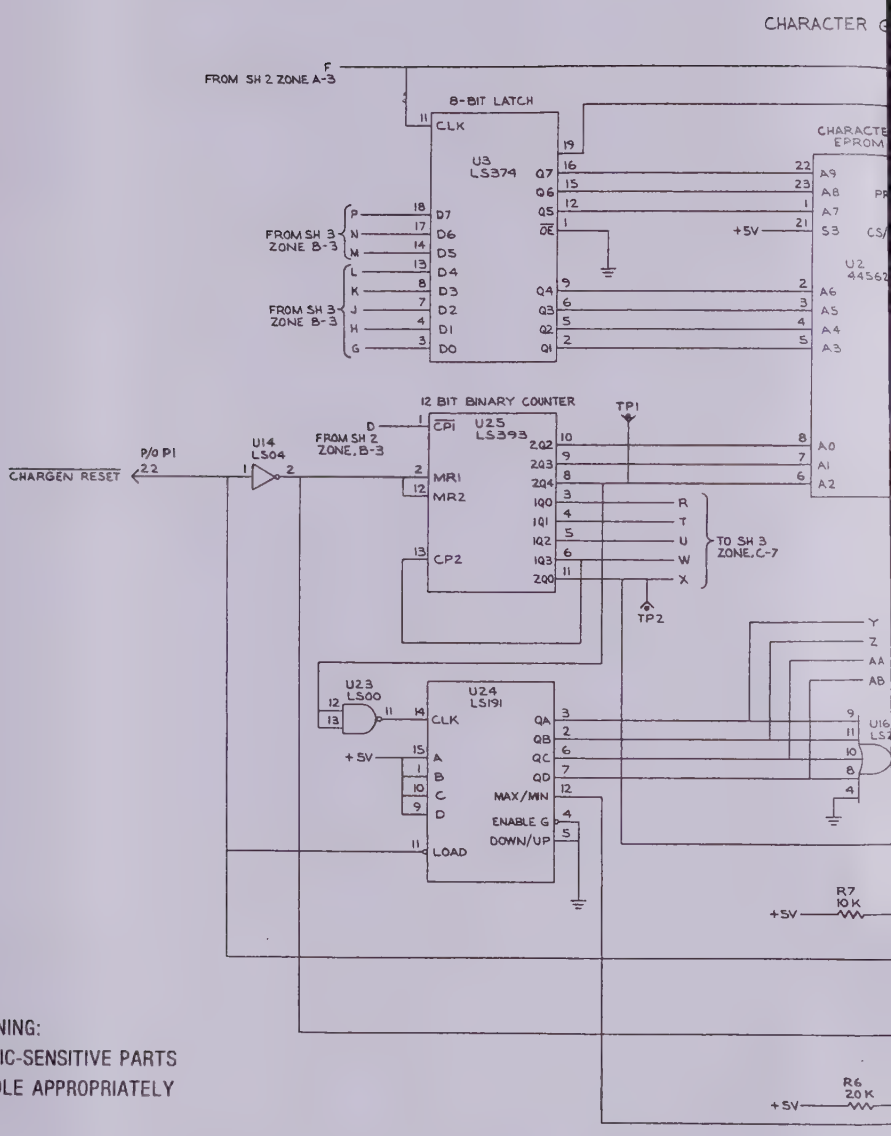
PROCESSOR BOARD (A14)

(RTC-1010A) 01-P29050H001

Figure 14-7d. Schematic (sheet 4 of 6)



71642-4



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

PROCESSOR BOARD (A14)

(RTC-1010A) 01-P290500H001

Figure 14-8. Printed Wiring Board Assembly and Parts List

PROCESSOR BOARD (A14)
RTC-1010A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
008	1	45-80339B28	CARD EJECTOR	
009	1	45-80339B33	CARD EJECTOR	MARKED
010	5	09-80339B81	SOCKET	28 PIN
BT001	1	60-80396A01	BATTERY,LITHIUM-MANGANESE	3V
C 001	1	23-80341B15	CAPACITOR	10UF-20-50
C 002	1	21-80342B10	CAPACITOR	.1UF-20-50
C 003	1	21-80342B10	CAPACITOR	.1UF-20-50
C 004	1	21-80342B10	CAPACITOR	.1UF-20-50
C 005	1	21-80342B10	CAPACITOR	.1UF-20-50
C 006	1	21-80342B10	CAPACITOR	.1UF-20-50
C 007	1	21-00850118	CAPACITOR	100PF-5-500
C 008	1	21-80342B10	CAPACITOR	.1UF-20-50
C 009	1	21-80342B10	CAPACITOR	.1UF-20-50
C 010	1	21-80342B10	CAPACITOR	.1UF-20-50
C 011	1	23-84665F25	CAPACITOR	47UF-20-10
C 012	1	21-80342B10	CAPACITOR	.1UF-20-50
C 013	1	21-80342B10	CAPACITOR	.1UF-20-50
C 014	1	21-80342B10	CAPACITOR	.1UF-20-50
C 015	1	21-80342B10	CAPACITOR	.1UF-20-50
C 016	1	21-80342B10	CAPACITOR	.1UF-20-50
C 017	1	21-80342B10	CAPACITOR	.1UF-20-50
C 018	1	21-80342B10	CAPACITOR	.1UF-20-50
C 019	1	21-80342B10	CAPACITOR	.1UF-20-50
C 020	1	21-80342B10	CAPACITOR	.1UF-20-50
C 021	1	21-80342B10	CAPACITOR	.1UF-20-50
C 022	1	21-80342B10	CAPACITOR	.1UF-20-50
C 023	1	21-80342B10	CAPACITOR	.1UF-20-50
C 024	1	21-80339B14	CAPACITOR	24PF-5-500
C 025	1	21-80339B14	CAPACITOR	24PF-5-500
C 026	1	21-80342B10	CAPACITOR	.1UF-20-50
C 027	1	21-80342B10	CAPACITOR	.1UF-20-50
C 028	1	21-80342B10	CAPACITOR	.1UF-20-50
C 029	1	21-80342B10	CAPACITOR	.1UF-20-50
C 030	1	21-80342B10	CAPACITOR	.1UF-20-50
C 031	1	21-80342B10	CAPACITOR	.1UF-20-50
C 032	1	21-80342B10	CAPACITOR	.1UF-20-50
C 033	1	21-80342B10	CAPACITOR	.1UF-20-50
C 034	1	21-80342B10	CAPACITOR	.1UF-20-50
C 035	1	21-80342B10	CAPACITOR	.1UF-20-50
C 036	1	21-80342B10	CAPACITOR	.1UF-20-50
C 037	1	21-80342B10	CAPACITOR	.1UF-20-50
C 038	1	21-80342B10	CAPACITOR	.1UF-20-50
C 039	1	21-80342B10	CAPACITOR	.1UF-20-50
C 040	1	21-80342B10	CAPACITOR	.1UF-20-50
C 041	1	21-80342B10	CAPACITOR	.1UF-20-50
C 042	1	21-80342B10	CAPACITOR	.1UF-20-50
C 043	1	21-80342B10	CAPACITOR	.1UF-20-50
C 044	1	21-80341B93	CAPACITOR	1000PF-20-100
C 045	1	21-80341B97	CAPACITOR	.1UF-20-100
C 046	1	21-80342B10	CAPACITOR	.1UF-20-50
C 047	1	21-80342B10	CAPACITOR	.1UF-20-50
C 048	1	21-80342B10	CAPACITOR	.1UF-20-50
C 049	1	21-80342B10	CAPACITOR	.1UF-20-50
C 050	1	21-80342B10	CAPACITOR	.1UF-20-50
C 090	1	21-80341B99	CAPACITOR	2200PF-20-100
CR001	1	48-80396A27	DIODE	
CR002	1	48-80396A27	DIODE	
CR003	1	48-80396A27	DIODE	
CR004	1	48-84463K02	DIODE	
Q 001	1	48-80341B22	TRANSISTOR	
R 001	1	06-10621C39	RESISTOR	2.87K-1-1/4
R 002	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 003	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 004	1	06-11009C73	RESISTOR	10K-5-1/4
R 005	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 006	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 007	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 008	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 009	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 010	1	06-11009C61	RESISTOR	3.3K-5-1/4
R 011	1	06-11009C49	RESISTOR	1K-5-1/4
R 014	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 015	1	06-11009C73	RESISTOR	10K-5-1/4
R 016	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 017	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 018	1	06-11009C73	RESISTOR	10K-5-1/4
R 019	1	06-11009C73	RESISTOR	10K-5-1/4
R 020	1	06-11009C73	RESISTOR	10K-5-1/4
R 021	1	06-11009C73	RESISTOR	10K-5-1/4
R 022	1	06-11009C73	RESISTOR	10K-5-1/4
R 023	1	06-11009C73	RESISTOR	10K-5-1/4
R 024	1	06-11009C73	RESISTOR	10K-5-1/4
R 025	1	06-11009C53	RESISTORS	1.5K-5-1/4

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 026	1	06-11009C80	RESISTOR	20K-5-1/4
R 027	1	06-11009C73	RESISTOR	10K-5-1/4
R 028	1	06-11009C61	RESISTOR	3.3K-5-1/4
TP001	1	09-80331A88	JACK	WHITE
TP002	1	09-80331A88	JACK	WHITE
TP003	1	09-80331A88	JACK	WHITE
TP004	1	09-80331A88	JACK	WHITE
TP005	1	09-80331A88	JACK	WHITE
TP006	1	09-80331A88	JACK	WHITE
TP007	1	09-80331A88	JACK	WHITE
TP008	1	09-80331A88	JACK	WHITE
TP009	1	09-80331A88	JACK	WHITE
U 001	1	51-05722G02	INTEGRATED CIRCUIT	
U 004	1	51-84561L36	INTEGRATED CIRCUIT	
U 005	1	51-80368A74	INTEGRATED CIRCUIT	SN74LS191N
U 006	1	51-90006B01	INTEGRATED CIRCUIT,	EPROM
U 007	1	51-90006B01	INTEGRATED CIRCUIT,	EPROM
U 008	1	51-90006B01	INTEGRATED CIRCUIT,	EPROM
U 009	1	51-90006B01	INTEGRATED CIRCUIT,	EPROM
U 010	1	51-82609M30	INTEGRATED CIRCUIT	
U 011	1	51-82609M67	INTEGRATED CIRCUIT	
U 012	1	51-80340B13	INTEGRATED CIRCUIT	
U 013	1	51-82609M53	INTEGRATED CIRCUIT	
U 014	1	51-80340B21	INTEGRATED CIRCUIT	
U 017	1	51-84561L03	INTEGRATED CIRCUIT	
U 018	1	51-82609M61	INTEGRATED CIRCUIT	
U 019	1	51-83627M93	INTEGRATED CIRCUIT	
U 020	1	51-83627M93	INTEGRATED CIRCUIT	
U 021	1	51-82609M79	INTEGRATED CIRCUIT	
U 022	1	51-82807K20	INTEGRATED CIRCUIT	
U 023	1	51-84561L42	INTEGRATED CIRCUIT	
U 024	1	51-84561L48	INTEGRATED CIRCUIT	
U 025	1	51-84561L48	INTEGRATED CIRCUIT	
U 026	1	51-84561L48	INTEGRATED CIRCUIT	
U 027	1	51-80339B86	INTEGRATED CIRCUIT	CMOS RAM
U 029	1	51-82609M57	INTEGRATED CIRCUIT	
U 030	1	51-82609M57	INTEGRATED CIRCUIT	
U 031	1	51-82609M48	INTEGRATED CIRCUIT	
U 033	1	51-84561L04	INTEGRATED CIRCUIT	
U 034	1	51-84561L11	INTEGRATED CIRCUIT	
U 036	1	51-80396A21	INTEGRATED CIRCUIT	CMOS RAM
U 037	1	51-80396A21	INTEGRATED CIRCUIT	CMOS RAM
U 038	1	51-82609M56	INTEGRATED CIRCUIT	
U 039	1	51-82609M56	INTEGRATED CIRCUIT	
U 040	1	51-82609M57	INTEGRATED CIRCUIT	
U 042	1	51-84561L03	INTEGRATED CIRCUIT	
U 043	1	51-84561L44	INTEGRATED CIRCUIT	
U 044	1	51-82609M79	INTEGRATED CIRCUIT	
U 045	1	51-80339B89	INTEGRATED CIRCUIT	EPROM
U 047	1	51-84561L07	INTEGRATED CIRCUIT	
U 048	1	51-84561L36	INTEGRATED CIRCUIT	
U 049	1	51-84561L04	INTEGRATED CIRCUIT	
U 050	1	51-84561L42	INTEGRATED CIRCUIT	
U 051	1	51-84561L42	INTEGRATED CIRCUIT	
U 052	1	51-84561L39	INTEGRATED CIRCUIT	
Y 001	1	48-80346A06	CRYSTAL	4.0 MHZ

SECTION 15.
FRONT-PANEL INTERFACE BOARD (A15)

15.1 DESCRIPTION

The Front-Panel Interface board provides two system functions. The first of these is to interface the system's Processor board (A14) with other system modules: primarily the Receiver board (A8), the Front-Panel Interface board itself, the RF Input module (A17), and the Front Panel (A18). The second function is to provide an analog interface between 1) external signals or internal-modulation/demodulation signals and 2) the basic measurement functions in the System Analyzer, the DVM, the scope, and the frequency counter.

A block diagram of the Front-Panel Interface board is shown at the end of this section in Figure 15-1, a schematic in Figure 15-2, and the printed wiring board assembly and parts list in Figure 15-3.

15.1.1 PROCESSOR-CONTROL INTERFACE

Control information for the front panel is carried by the AF DATA BUS in 4-bit groups. Information that the microprocessor reads from the Front-Panel Interface includes encoded data from the RF ATTN 0-130 and horizontal SWP SEL inputs, data from the vertical RNG SEL INPUTS, and data from other miscellaneous inputs. Information that the microprocessor sends to the Front-Panel Interface includes data that controls the input switches (Q2, Q3, Q6), the range attenuator (Q4, Q5, Q7, Q8), and the LEDs on the front panel.

Data is transferred to the AF DATA BUS by 3-state input buffers U13, U17, U19, and U20, and it is transferred from the AF DATA BUS by latches U8 and U9. The microprocessor sequentially addresses each buffer and latch through the AF ADD BUS and address decoder U21. Data is transferred to/from the selected latch/buffer while the AF BUS EN 2 signal is low.

15.1.2 ANALOG INTERFACE

The analog outputs of the Front-Panel Interface are driven by four amplifiers: the scope-vertical pre-amplifier (U3, Q9, Q13, Q14), the DVM buffer amplifier (U5, U6, U4B), the frequency-counter pre-amplifier (Q12, U7) and the scope-horizontal pre-amplifier (U4A). Circuits for input selection (K2-K4, Q2, Q3, Q6), the range attenuator (K5-K8, Q4, Q5, Q7, Q8), and the unity-gain buffer amplifier (Q1) drive the inputs of the first three amplifiers. The input to the scope-horizontal pre-amplifier comes directly from the edge-card connector.

15.2 THEORY OF OPERATION

15.2.1 PROCESSOR-CONTROL INTERFACE

15.2.1.1 AF Bus

Information is carried between the microprocessor and the Front-Panel Interface by the AF Bus. It consists of a 4-bit, tri-state data bus (AF DATA BUS 0-3) and a 4-bit address bus (AF ADD BUS 0-3). When AF BUS EN 2 is asserted low, the input/output (I/O) function of the AF DATA BUS lines is determined by the address on the AF ADD BUS lines. Depending on that address, address decoder U21 can select the following I/O devices: 1) data buffers U13, U17, U19, and U20; 2) data latches U8 and U9; and data latches A18U6, A18U7, and A18U8.

A summary of the functions of the AF DATA BUS lines for each state of the AF ADD BUS is given in Table 15-1.

15.2.1.2 LED Control

The AF BUS ADDRESSES 0, 1, and 2 control the output to the display, function, and modulation LEDs on the Front-Panel Display board (A18A1). Latch-selects LS0, LS1, and LS2 are asserted low to latch the data that is present on the AF ADD BUS. These latch-selects and the AF DATA BUS are connected to the Display board (A18A1) via J1 and a ribbon cable assembly.

Table 15-2 shows which LED is selected when the state of the AF DATA BUS is as shown and the appropriate latch-select (LS0, LS1, or LS2) is strobed low.

15.2.1.3 Range-Attenuator Control (ATTN X1, X0.1, X0.01, X0.001)

Location 3 of the AF BUS accesses outputs which control the range attenuator. Table 15-3 shows the allowable states of these four control bits, and the function of those states.

Table 15-1. AF ADD and DATA BUS

AF BUS EN 2	AF ADD BUS Lines 3	2	1	0	INPUT/ OUTPUT	LSX ASSERTED	AF DATA BUS 3	AF DATA BUS 2	AF DATA BUS 1	AF DATA BUS 0	NOTE
0	0	0	0	0	I	0	DISPLAY 3	DISPLAY 2	DISPLAY 1	DISPLAY 0	*
0	0	0	0	1	I	1	FUNCTION 3	FUNCTION 2	FUNCTION 1	FUNCTION 0	*
0	0	0	1	0	I	2	MODE 3	MODE 2	MODE 1	MODE 0	*
0	0	0	1	1	I	3	ATTEN X 0.001	ATTEN X 0.01	ATTEN X 0.1	ATTEN X 1	
0	0	1	0	0	I	4	Not Used	Not Used	EXT INPUT SELECT	DC SELECT	
0	0	1	0	1	O	5	RF ATTEN 3	RF ATTEN 2	RF ATTEN 1	RF ATTEN 0	
0	0	1	1	0	O	6	RF OVER TEMP	WB SIG PRES	ANT SEL	SPARE	
0	0	1	1	1	O	7	IF OVERLOAD	SIG PRES	OFFSET ON/ OFF	WB/NB	
0	1	0	0	0	O	8	CSSG CONT EN	CSSG BURST EN	IMAGE HI/LO	MON/GEN	
0	1	0	0	1	O	9	10V/DIV RNG SEL	1V/DIV RNG SEL	0.1V/DIV RNG SEL	0.01V/DIV RNG SEL	
0	1	0	1	0	O	10	SPARE BIT	SWP SEL 2	SWP SEL 1	SWP SEL 0	
0	1	0	1	1	X	N	X	X	X	X	
0	1	1	X	X	X	N	X	X	X	X	
1	X	X	X	X	X	N	X	X	X	X	

*LS0-LS2 are decoded and sent to A18. Decoding of data shown is done on A18.

Table 15-2. Decoding for Display, Function, and Modulation LEDs

AF DATA BUS Lines 0	1	2	3	Display LED Selected (LS0 Strobed Low)	Function LED Selected (LS1 Strobed Low)	Modulation LED Selected (LS2 Strobed Low)
0	0	0	0	Gen/Mon Mtr	FM	PL/DPL
0	0	0	1	Modulation	CW	PL/DPL INV
0	0	1	0	Spect Analyzer	AM	Tone A
0	0	1	1	Duplex Gen	SSB/DSBSC	Tone B
0	1	0	0	RF Memory	SWP 1-10 MHz	Tone Seq
0	1	0	1	Signaling Seq	SWP 0.01-1 MHz	Tone Remote
0	1	1	0	Freq Counter	Not Allowed	Not Allowed
0	1	1	1	DVM/DIST	Not Allowed	Not Allowed
1	0	0	0	Ext Wattmeter	Not Allowed	Not Allowed
1	0	0	1	IF	Not Allowed	Not Allowed
1	0	1	0	Scope AC	Not Allowed	Not Allowed
1	0	1	1	Scope DC	Not Allowed	Not Allowed
1	1	0	0	Not Allowed	Not Allowed	Not Allowed
1	1	0	1	Not Allowed	Not Allowed	Not Allowed
1	1	1	0	Not Allowed	Not Allowed	Not Allowed
1	1	1	1	Not Allowed	Not Allowed	Not Allowed

Table 15-3. Range-Attenuator Switching

Attenuation	ATTEN Lines X0.001	X0.01	X0.1	X1	Gain from Selected Input to DVM FROM RNG SW Output	Gain from Selected Input to VERT FROM RNG SW Output (VERNIER CAL POS)	Sensitivity of EXT FREQ. CNTR and $\overline{\text{EXT FREQ. CNTR}}$ Outputs to Selected Input
X1	0	0	0	1	1	50	30 MV
X0.1	0	0	1	0	0.1	5	300 MV
X0.01	0	1	0	0	0.01	0.5	3 V
X0.001	1	0	0	0	0.001	0.05	30 V

15.2.1.4 Input-Switching Control

Location 4 of the AF BUS accesses outputs which control selection of the external (P1-1) or internal (P1-24) inputs and ac or dc coupling of the external input. This control is achieved with data-bus bits 0 and 1 as shown in Table 15-4.

Table 15-4. Input Switching

EXT INPUT SELECT	DC SELECT	Input Source	Coupling
1	1	EXT INPUT	dc
1	0	EXT INPUT	ac
0	X	INT SCOPE TO RNG SW	dc

15.2.1.5 RF-Attenuator Encoding

The RF ATTEN 0-130 dB inputs indicate the setting of the RF step attenuator in the RF Input module (A17). When one of these inputs is driven high, the corresponding attenuation has been selected. These fourteen inputs are converted to a 4-bit code (RF ATTEN 0-3) by priority encoders U10 and U12 and OR gates U12. Location 5 of the AF BUS accesses these outputs. Table 15-5 shows the encoding of the RF ATTEN 0-130 dB inputs into the RF ATTEN 0-3 output.

Table 15-5. RF-Attenuator Encoding

RF ATTEN Lines														RF ATTEN Bits			
130 dB	120 dB	110 dB	100 dB	90 dB	80 dB	70 dB	60 dB	50 dB	40 dB	30 dB	20 dB	10 dB	0 dB	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1
0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1
0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1
0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0
0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1
0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0
0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1

15.2.1.6 Miscellaneous Inputs

Locations 6-8 of the AF BUS access miscellaneous data inputs. Table 15-1 gives the specific location of each input on the bus. Table 15-6 gives a brief description of each input.

Table 15-6. Functions of Miscellaneous Inputs

Input	Function
RF OVER TEMP	When high, indicates the Wattmeter (A17A1) is overheated.
$\overline{\text{WB SIG PRES}}$	Comes from the Receiver (A8) – during the system's scan-acquisition, indicates the presence of a signal at the monitor input.
ANT SEL	Comes from the Front Panel (A18) – selects the system's I/O port. When the variable RF Level control is pulled out, this signal goes high, selecting the Antenna port. When the control is pushed in, this signal goes low, selecting the RF In/Out port.
$\overline{\text{IF OVERLOAD}}$	Comes from the Receiver – indicates the monitor is being over-driven.
$\overline{\text{SIG PRES}}$	Comes from the Receiver – indicates the presence of a signal on the monitor input which is sufficiently high to open the Receiver squelch.
OFFSET ON/OFF	Indicates the position of the Duplex Gen switch on the RF Input module (A17).
WB/NB	Indicates the position of the bandwidth (BW) switch on the front panel.
$\overline{\text{CSSG CONT EN}}$ and $\overline{\text{CSSG BURST EN}}$	Indicate whether the front panel's Modulation switch is set to Cont or Burst, respectively.
IMAGE HI/LO	Indicates the position of the Image/Duplex switch on the front panel.
MON/GEN	Indicates the position of the Function switch on the front panel.

15.2.1.7 Range-Select Inputs

The 0.01 to 10V/Div RNG SEL inputs indicate which scope vertical-input sensitivity has been selected. When one of these inputs is low, the corresponding sensitivity has been selected. The microprocessor programs the appropriate attenuation in the range attenuator via the ATTN X0.001 to 1 signals. Location 9 on the AF BUS accesses the 0.01 to 10V/Div RNG SEL inputs.

15.2.1.8 Sweep-Select Encoding

The 1 µs to 100 ms/DIV SWP SEL and EXT HORIZ SEL inputs indicate the position of the Oscilloscope Horiz switch on the front panel. When one of these inputs is high, the corresponding switch position has been selected. These inputs are converted to a 3-bit code, SWP SEL 0-2, by priority encoder U18, according to the algorithm in Table 15-7. Location 10 on the AF BUS accesses the SWP SEL 0-2 outputs.

Table 15-7. Sweep-Select Encoding

SWP SEL Lines							SWP SEL Bits		
EXT HORIZ SEL	100 ms/DIV	10 ms/DIV	1 ms/DIV	100 µs/DIV	10 µs/DIV	1 µs/DIV	2	1	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	0	0
0	0	0	0	0	1	0	0	0	1
0	0	0	0	1	0	0	0	1	0
0	0	0	1	0	0	0	0	1	1
0	0	1	0	0	0	0	1	0	0
0	1	0	0	0	0	0	1	0	1
1	0	0	0	0	0	0	1	1	0

15.2.1.9 RF-Scan Encoding

The OPTICAL ENC A and B inputs carry information from the RF Scan optical encoder on the front panel. This encoder is interfaced to the system microprocessor by U22, U23, and Q16 on the Front-Panel Interface. As the RF Scan control is rotated, each change in the OPTICAL ENC A input causes the FIRQ output, which goes to the microprocessor, to pull low for approximately 10 µs. The OPTO CCW output, which goes to a PIA on the Processor board (A14), indicates the direction of the scanning. This output is generated by latching the OPTICAL ENC B input and exclusively ORing it with the OPTICAL ENC A input.

15.2.1.10 Input/Output Characteristics

All digital inputs and outputs are interfaced to 'B' series CMOS logic, which operates from 0V/5V supplies. To facilitate interface with a mechanical switch, some inputs have pull-up or pull-down resistors.

15.2.1.11 Miscellaneous Front-Panel Interconnections

The Front-Panel Interface provides miscellaneous interconnections between the front panel and the rest of the system. These connections come from the front panel through two ribbon cables and connectors, J1 and J2. They are then routed through edge connector P1.

15.2.2 ANALOG INTERFACE

15.2.2.1 Input Switching (K2-K4, Q2, Q3, Q6)

The input to the range attenuator can be selected from either the EXT INPUT or the INT SCOPE TO RNG SW inputs. Ac or dc coupling may be selected for the external input. Input switching is controlled by the DC SELECT and EXT INPUT SELECT signals, as shown in Table 15-4. The generation of these signals is discussed in paragraph 15.2.1.4.

15.2.2.2 Range Attenuator (K5-K8, Q4, Q5, Q7, Q8)

The range attenuator provides four selectable values of attenuation: X1, X0.1, X0.01, and X0.001. Attenuation is controlled by the ATTEN X0.001 to 1 signals, as shown in Table 15-3. Compensation capacitor C11 is adjusted for maximum bandwidth. To adjust C11, see Section 3 on alignment.

15.2.2.3 Unity-Gain Buffer Amplifier

Unity-gain buffer amplifier Q11 buffers the signals under test from the frequency-counter pre-amplifier, the DVM buffer amplifier, and the scope's vertical pre-amplifier inputs. R54 (coarse) and R55 (fine) are adjusted so that there is a voltage gain of one from the EXT INPUT to TP1. To align R54 and R55, see Section 3 on alignment.

15.2.2.4 Scope Vertical Pre-Amplifier (U3, Q9, Q13, Q14)

The scope's vertical pre-amplifier has a nominal gain of 50 when the front panel's vertical-gain potentiometer (which is connected between VERT GAIN and VERT GAIN RETURN) is set to 0 ohms. When the gain potentiometer is set at 5K ohms, the gain of the amplifier is less than or equal to 5. The front panel's 5K ohm vertical-position potentiometer (which is connected between VERT POSITION and ground) varies the dc offset of the amplifier. This amplifier drives the VERT FROM RNG SW output. R19 and R25 adjust the gain and balance, respectively, of the vertical pre-amplifier. To align R19 and R25, see Section 3 on alignment.

Table 15-3 shows, as a function of the range-attenuator setting, the vertical pre-amplifier's gain from the selected input to the VERT FROM RNG SW output.

15.2.2.5 DVM Buffer Amplifier

The DVM buffer amplifier provides switched-bandwidth buffering between the unity-gain amplifier (Q11) and the DVM circuitry on the Scope/DVM Control board (A7). In ac mode, operational amplifier U7 operates as a unity-gain amplifier with a gain flatness of ± 2 percent out to 20 kHz. In dc mode, analog switches U6A and U6C switch C26 and C22, respectively, into the amplifier circuit. In this configuration, the amplifier has a dc gain of 1 and a minimum attenuation of 30 dB at 50 Hz. The amplifier bandwidth is controlled by a signal from latch U9, which has the opposite sense of the DC SELECT signal. U4B inverts the sense of this signal and then translates it from a logic level of 0 to $+5$V to a logic level of -8 to $+8$V. The signal is now compatible with the control inputs of U6A and U6C. R41 is adjusted for a gain of one from TP1 to the DVM FROM RNG SW output. To adjust R41, see Section 3 on alignment.

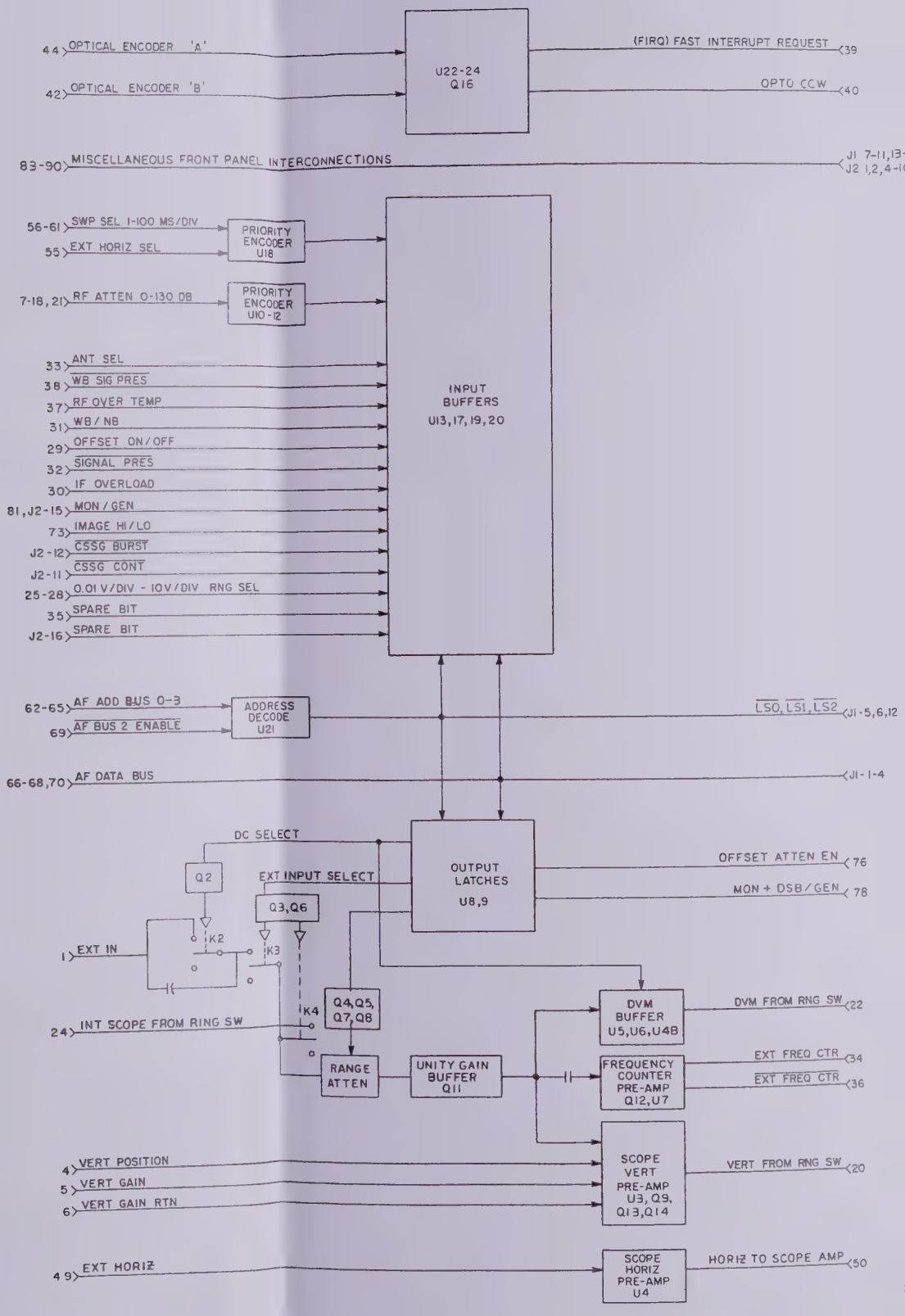
Table 15-3 shows the gain from the selected input to the DVM FROM RNG SW output as a function of the range-attenuator setting.

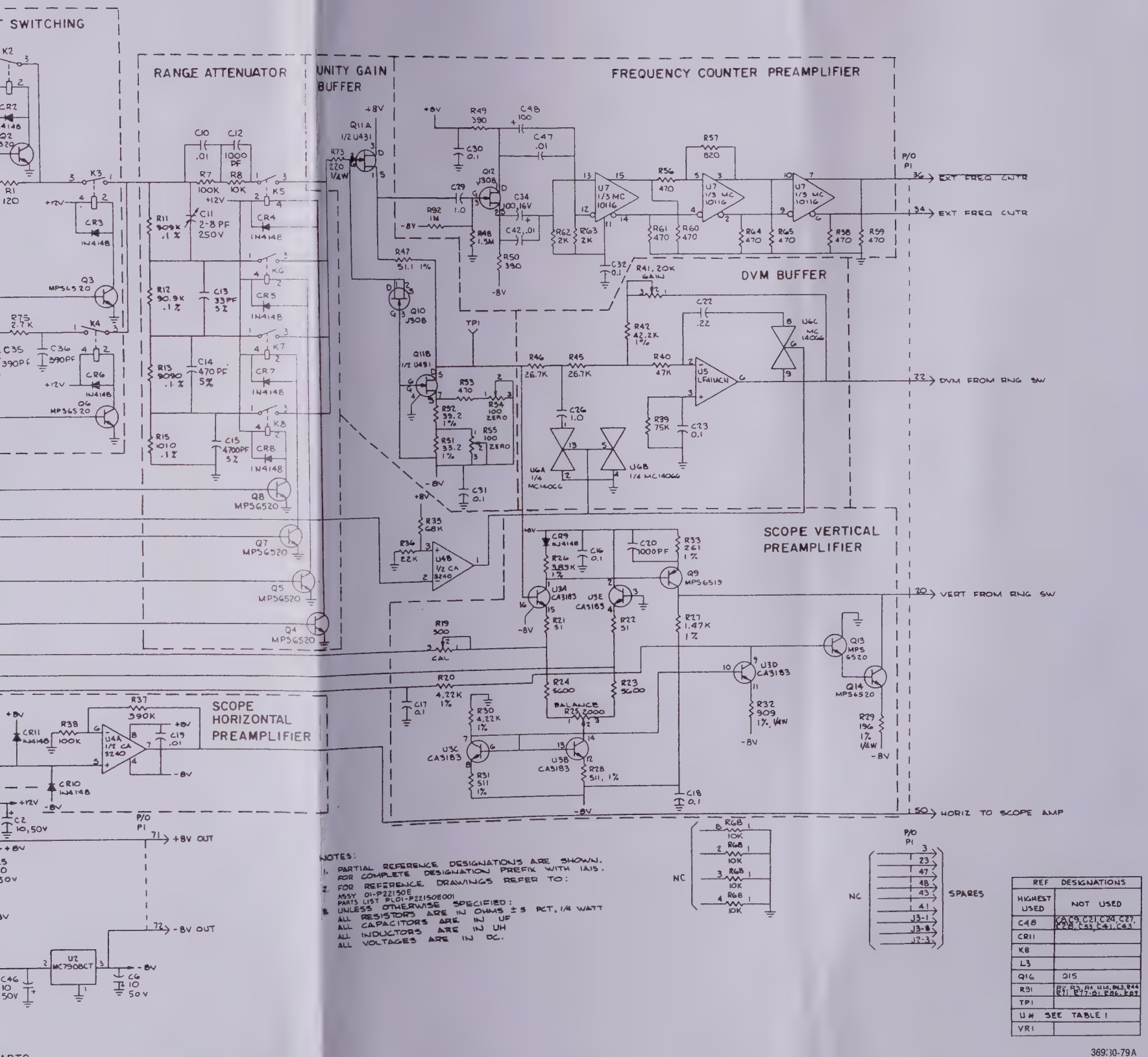
15.2.2.6 Frequency-Counter Pre-Amplifier

The frequency-counter pre-amplifier (Q12 and U7) converts the output of unity-gain buffer Q11 to ECL levels. The output is differentially connected through the EXT FREQ CNTR and $\overline{\text{EXT FREQ CNTR}}$ outputs to the Processor Interface board (A11). Table 15-3 shows the sensitivity of this amplifier as a function of the range attenuator.

15.2.2.7 Scope Horizontal Pre-Amplifier

The scope's horizontal pre-amplifier provides a nominal voltage gain of 5 between the HORIZ INPUT and the HORIZ TO SCOPE AMP output.

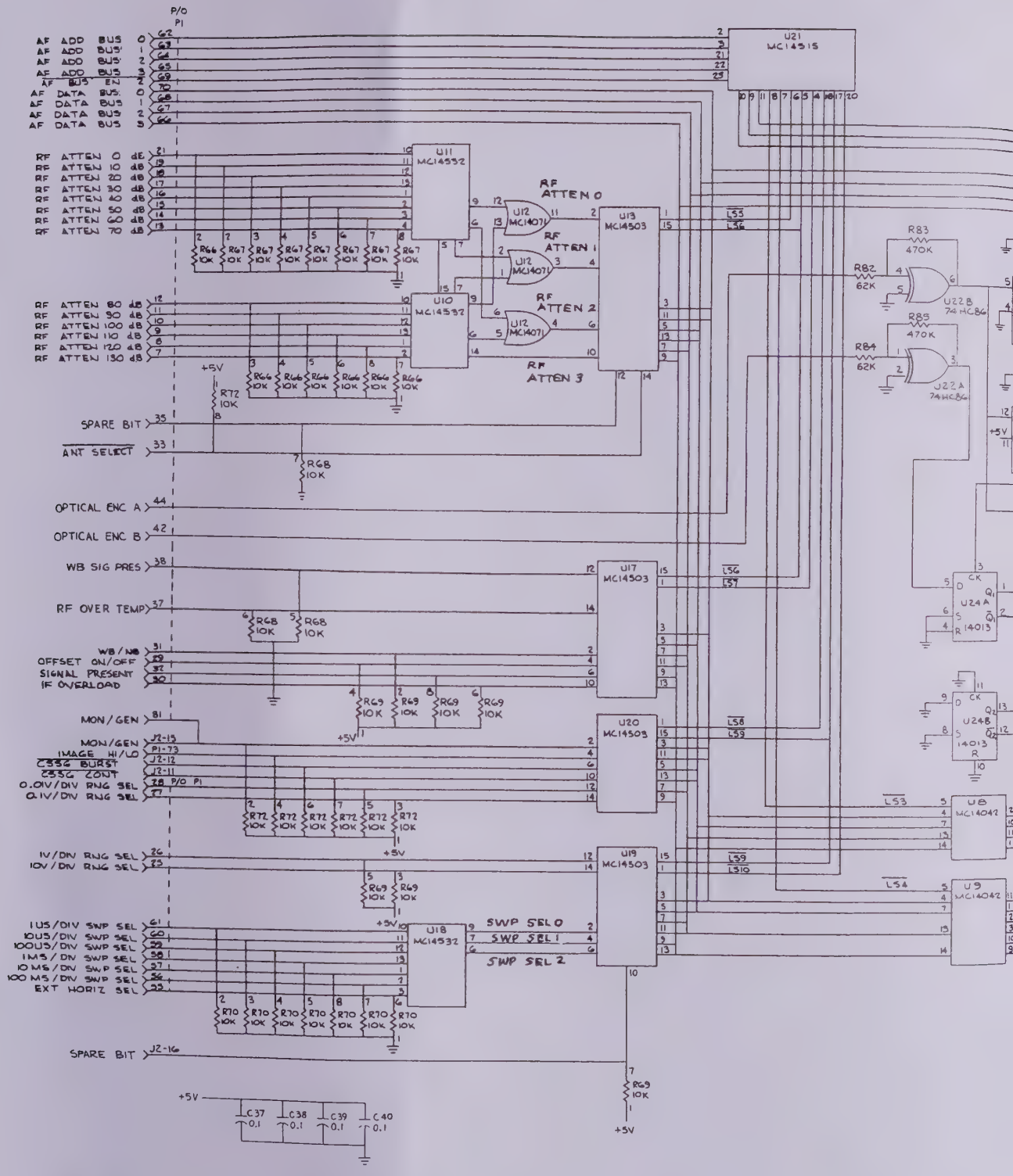

44 OPTICAL ENCODER 'A'
42 OPTICAL ENCODER 'B'
U22-24 Q16
(FIRQ) FAST INTERRUPT REQUEST 39
OPTO CCW 40
83-90 MISCELLANEOUS FRONT PANEL INTERCONNECTIONS
J1 7-11,13-
J2 1,2,4-1
56-61 SWP SEL 1-100 MS/DIV
55 EXT HORIZ SEL
PRIORITY ENCODER U18
7-18,21 RF ATTEN 0-130 DB
PRIORITY ENCODER U10-12
33 ANT SEL
38 WB SIG PRES
37 RF OVER TEMP
31 WB/NB
29 OFFSET ON/OFF
32 SIGNAL PRES
30 IF OVERLOAD
81,J2-15 MON/GEN
73 IMAGE HI/LO
J2-12 CSSG BURST
J2-11 CSSG CONT
25-28 0.01 V/DIV - 10V/DIV RNG SEL
35 SPARE BIT
J2-16 SPARE BIT
INPUT BUFFERS U13,17,19,20
62-65 AF ADD BUS 0-3
69 AF BUS 2 ENABLE
ADDRESS DECODE U21
LS0, LS1, LS2 J1-5,6,12
66-68,70 AF DATA BUS
J1-1-4
DC SELECT
Q2
EXT INPUT SELECT
Q3,Q6
OUTPUT LATCHES U8,9
OFFSET ATTEN EN 76
MON + DSB/GEN 78
1 EXT IN
K2
K3
K4
24 INT SCOPE FROM RING SW
Q4,Q5, Q7,Q8
RANGE ATTEN
UNITY GAIN BUFFER Q11
DVM BUFFER U5,U6,U4B
DVM FROM RNG SW 22
FREQUENCY COUNTER PRE-AMP Q12,U7
EXT FREQ CTR 34
EXT FREQ CTR 36
4 VERT POSITION
5 VERT GAIN
6 VERT GAIN RTN
SCOPE VERT PRE-AMP U3, Q9, Q13,Q14
VERT FROM RNG SW 20
49 EXT HORIZ
SCOPE HORIZ PRE-AMP U4
HORIZ TO SCOPE AMP 50



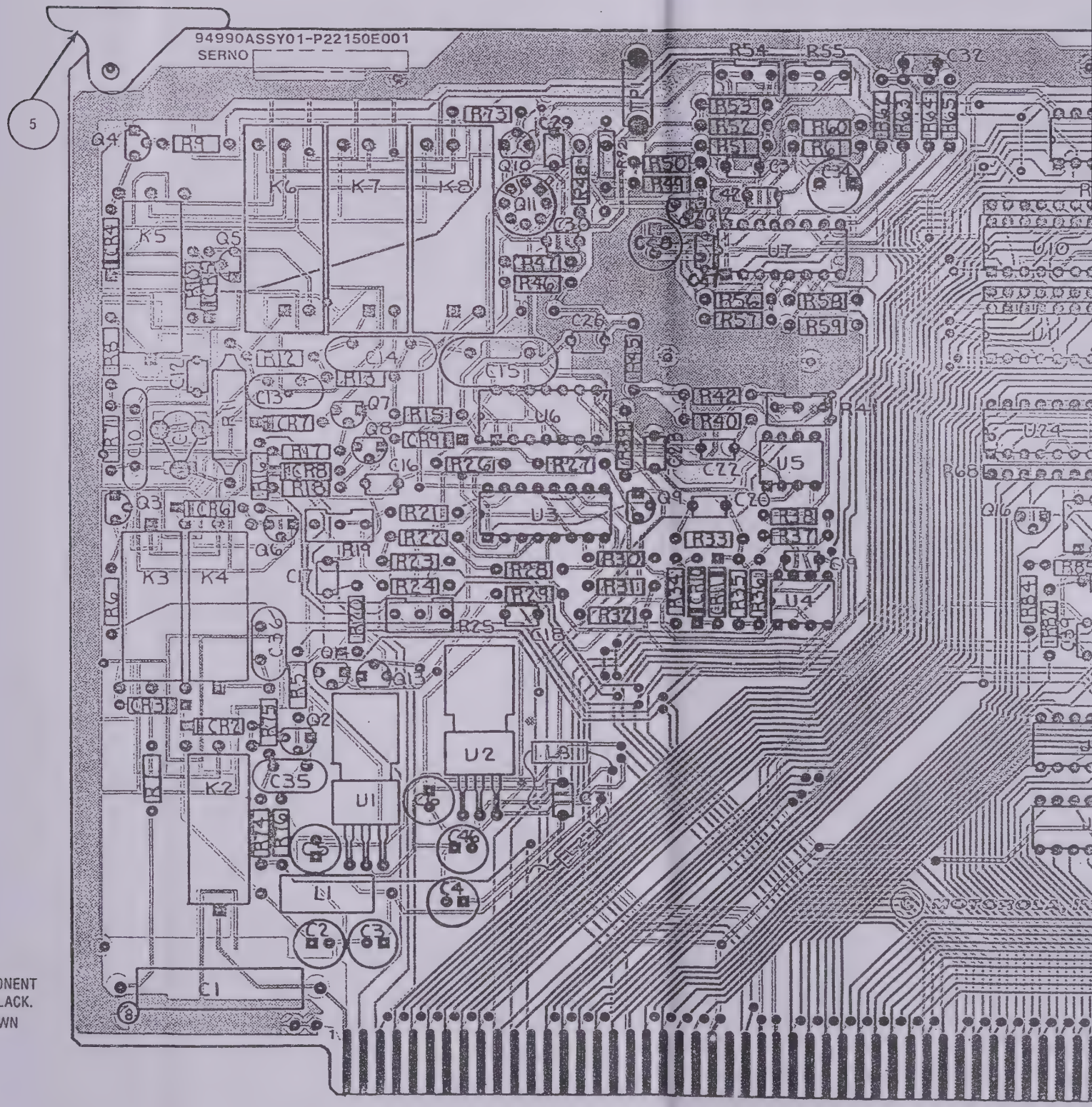
NOTES:
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATION PREFIX WITH 1A1S.
2. FOR REFERENCE DRAWINGS REFER TO: ASSY 01-P22150E PARTS LIST PL01-P22150E001
3. UNLESS OTHERWISE SPECIFIED: ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT ALL CAPACITORS ARE IN UF ALL INDUCTORS ARE IN UH ALL VOLTAGES ARE IN DC.

REF DESIGNATIONS	
HIGHEST USED	NOT USED
C48	C6, C9, C21, C24, C27, C28, C33, C41, C43
CR11	
K8	
L3	
Q16	Q15
R91	R2, R3, R4, R14, R43, R44, R51, R77, Q1, R86, R87
TP1	
U*	SEE TABLE 1
VR1	

369'30-79A



WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY



COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE

FRONT-PANEL INTERFACE BOARD (A15) (Cont)

RTC-1011A

Find No.	Qty. Req.	Part No.	Nomenclature	Part Value
R 010	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 011	1	06-80396A73	RESISTOR	909K-.1-1/4
R 012	1	06-80396A71	RESISTOR	90.9K-.1-1/4
R 013	1	06-80396A70	RESISTOR	9090-.1-1/4
R 015	1	06-80396A60	RESISTOR	1010-.1-1/4
R 016	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 017	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 018	1	06-11009C65	RESISTOR	4.7K-5-1/4
R 019	1	18-83452F07	RESISTOR,VARIABLE	500
R 020	1	06-10621C55	RESISTOR	4.22K-1-1/4
R 021	1	06-11009C18	RESISTOR	51-5-1/4
R 022	1	06-11009C18	RESISTOR	51-5-1/4
R 023	1	06-11009C67	RESISTOR	5.6K-5-1/4
R 024	1	06-11009C67	RESISTOR	5.6K-5-1/4
R 025	1	18-83452F01	RESISTOR,VARIABLE	2K
R 026	1	06-10621C51	RESISTOR	3.83K-1-1/4
R 027	1	06-10621C11	RESISTOR	1.47K-1-1/4
R 028	1	06-10621B66	RESISTOR	511-1-1/4
R 029	1	06-10621B26	RESISTOR	196-1-1/4
R 030	1	06-10621C55	RESISTOR	4.22K-1-1/4
R 031	1	06-10621B66	RESISTOR	511-1-1/4
R 032	1	06-10621B90	RESISTOR	909-1-1/4
R 033	1	06-10621B38	RESISTOR	261-1-1/4
R 034	1	06-11009C73	RESISTOR	10K-5-1/4
R 035	1	06-11009C93	RESISTOR	68K-5-1/4
R 036	1	06-11009C81	RESISTOR	22K-5-1/4
R 037	1	06-11009D12	RESISTOR	390K-5-1/4
R 038	1	06-11009C97	RESISTOR	100K-5-1/4
R 039	1	06-11009C94	RESISTOR	75K-5-1/4
R 040	1	06-11009C89	RESISTOR	47K-5-1/4
R 041	1	18-83452F15	RESISTOR,VARIABLE	20K
R 042	1	06-10621D52	RESISTOR	42.2K-1-1/4
R 045	1	06-10621D33	RESISTOR	26.7K-1-1/4
R 046	1	06-10621D33	RESISTOR	26.7K-1-1/4
R 047	1	06-10621A69	RESISTOR	51.1-1-1/4
R 048	1	06-10621F03	RESISTOR	1.5M-5-1/4
R 049	1	06-11009C39	RESISTOR	390-5-1/4
R 050	1	06-11009C39	RESISTOR	390-5-1/4
R 051	1	06-10621D42	RESISTOR	33.2-1-1/4
R 052	1	06-10621A58	RESISTOR	39.2-1-1/4
R 053	1	06-11009C41	RESISTOR	470-5-1/4
R 054	1	18-83452F03	RESISTOR,VARIABLE	100
R 055	1	18-83452F03	RESISTOR,VARIABLE	100
R 056	1	06-11009C41	RESISTOR	470-5-1/4
R 057	1	06-11009C47	RESISTOR	820-5-1/4
R 058	1	06-11009C41	RESISTOR	470-5-1/4
R 059	1	06-11009C41	RESISTOR	470-5-1/4
R 060	1	06-11009C41	RESISTOR	470-5-1/4
R 061	1	06-11009C41	RESISTOR	470-5-1/4
R 062	1	06-11009C56	RESISTOR	2K-5-1/4
R 063	1	06-11009C56	RESISTOR	2K-5-1/4
R 064	1	06-11009C41	RESISTOR	470-5-1/4
R 065	1	06-11009C41	RESISTOR	470-5-1/4
R 066	1	06-80340B10	RESISTOR	10K
R 067	1	06-80340B10	RESISTOR	10K
R 068	1	06-80340B10	RESISTOR	10K
R 069	1	06-80340B10	RESISTOR	10K
R 070	1	06-80340B10	RESISTOR	10K
R 072	1	06-80340B10	RESISTOR	10K
R 073	1	06-11009C33	RESISTOR	220-5-1/4
R 074	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 075	1	06-11009C59	RESISTOR	2.7K-5-1/4
R 076	1	06-11009C73	RESISTOR	10K-5-1/4
R 082	1	06-11009C92	RESISTOR	62K-5-1/4
R 083	1	06-11009D14	RESISTOR	470K-5-1/4
R 084	1	06-11009C92	RESISTOR	62K-5-1/4
R 085	1	06-11009D14	RESISTOR	470K-5-1/4
R 090	1	06-11009C89	RESISTOR	47K-5-1/4
R 091	1	06-11009C89	RESISTOR	47K-5-1/4
R 092	1	06-11009D22	RESISTOR	1M-5-1/4
TP001	1	09-80331A88	JACK	WHITE
U 001	1	51-05292H02	INTEGRATED CIRCUIT	
U 002	1	51-80345A07	INTEGRATED CIRCUIT	MC7908CT SCREENED
U 003	1	51-80343B25	INTEGRATED CIRCUIT	CA3183E SCREENED
U 004	1	51-80345A04	INTEGRATED CIRCUIT	CA3240E SCREENED
U 005	1	51-80339B98	INTEGRATED CIRCUIT	
U 006	1	51-82884L71	INTEGRATED CIRCUIT	
U 007	1	51-80323A60	INTEGRATED CIRCUIT	
U 008	1	51-82884L15	INTEGRATED CIRCUIT	
U 009	1	51-82884L15	INTEGRATED CIRCUIT	
U 010	1	51-80074C03	INTEGRATED CIRCUIT	
U 011	1	51-80074C03	INTEGRATED CIRCUIT	
U 012	1	51-82884L52	INTEGRATED CIRCUIT	
U 013	1	51-82884L74	INTEGRATED CIRCUIT	
U 017	1	51-82884L74	INTEGRATED CIRCUIT	
U 018	1	51-80074C03	INTEGRATED CIRCUIT	
U 019	1	51-82884L74	INTEGRATED CIRCUIT	
U 020	1	51-82884L74	INTEGRATED CIRCUIT	
U 021	1	51-80340B18	INTEGRATED CIRCUIT	
U 022	1	51-80340B81	INTEGRATED CIRCUIT	
U 023	1	51-82884L28	INTEGRATED CIRCUIT	
U 024	1	51-05596E15	INTEGRATED CIRCUIT	

SECTION 16.
FREQUENCY-STANDARD INTERFACE BOARD (A16)

16.1 DESCRIPTION

The Frequency-Standard Interface board provides the 10-MHz timebase for the System Analyzer and the interface for an external 10-MHz input. A standard temperature-compensated crystal oscillator (TCXO) provides stability of ± 1 PPM. An optional oven-compensated crystal oscillator (OCXO) provides stability of ± 0.05 PPM over temperature variation.

A block diagram of the 10-MHz Frequency-Standard Interface board is shown in Figure 16-1, a schematic in Figure 16-2, the printed wiring board assembly and the parts list in Figure 16-3, and the assembly and parts list in Figure 16-4.

16.2 THEORY OF OPERATION

16.2.1 INTERNAL SOURCE

Oscillator A16A2 generates a 10-MHz signal that is split to two amplifiers. One amplifier (Q3) provides the internal timebase; the other amplifier (Q2) provides the external timebase. The two identical amplifiers provide a peak-to-peak signal of 1 to 2V (as adjusted by R18) into a 50-ohm load.

A voltage regulator (U1 and Q1) on the board supplies the voltage to the oscillator and monitors the supply current. For the ovenized option, at power on, the oven draws high current at approximately 1A. As the oven warms up, the current decreases, reaching some low value when the operating temperature is reached. A current detector turns the oven-ready indicator on when the current has decreased to the stabilized value of approximately 325 mA.

16.2.2 EXTERNAL SOURCE

An external 10-MHz timebase can be used by switching S1 (accessible from the bottom of the Analyzer) to the external position. The external source is amplified by Q3, which has an input impedance of 10K ohm. The external source signal must be between 175 mVrms and 2.0 Vrms into 10K ohm.

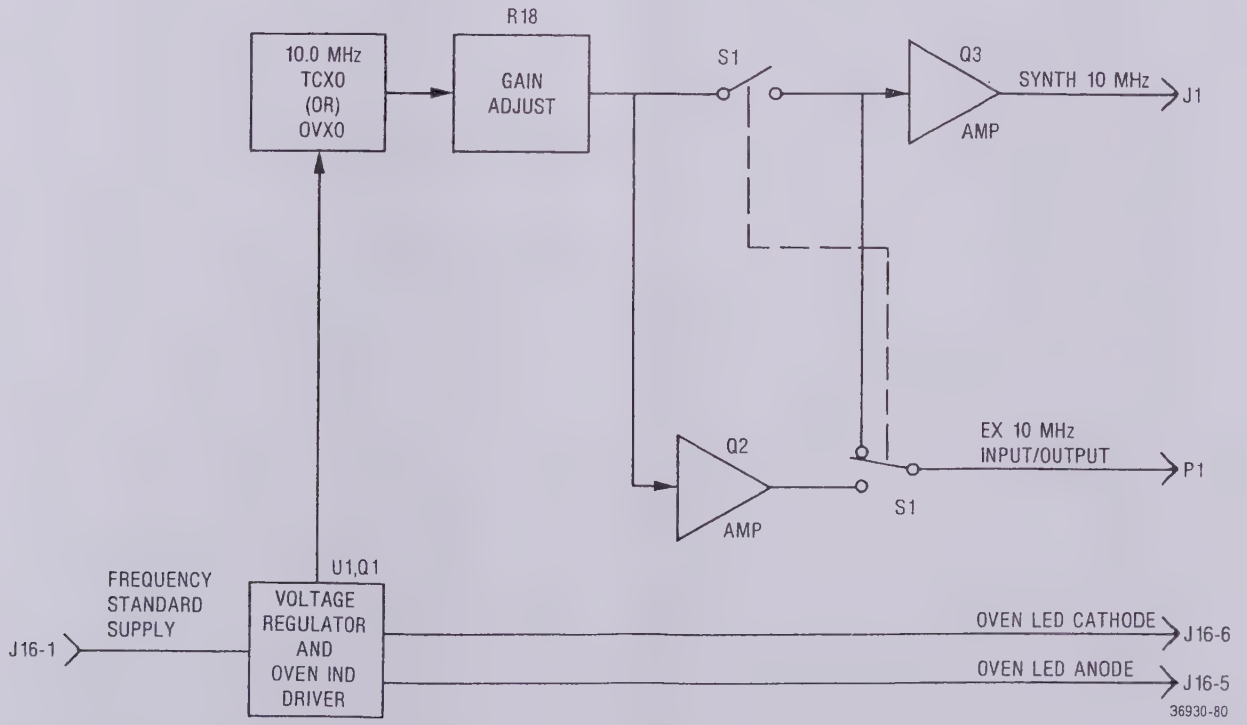


Figure 16-1. Frequency–Standard Interface Board (A16) — Block Diagram

NOTES:

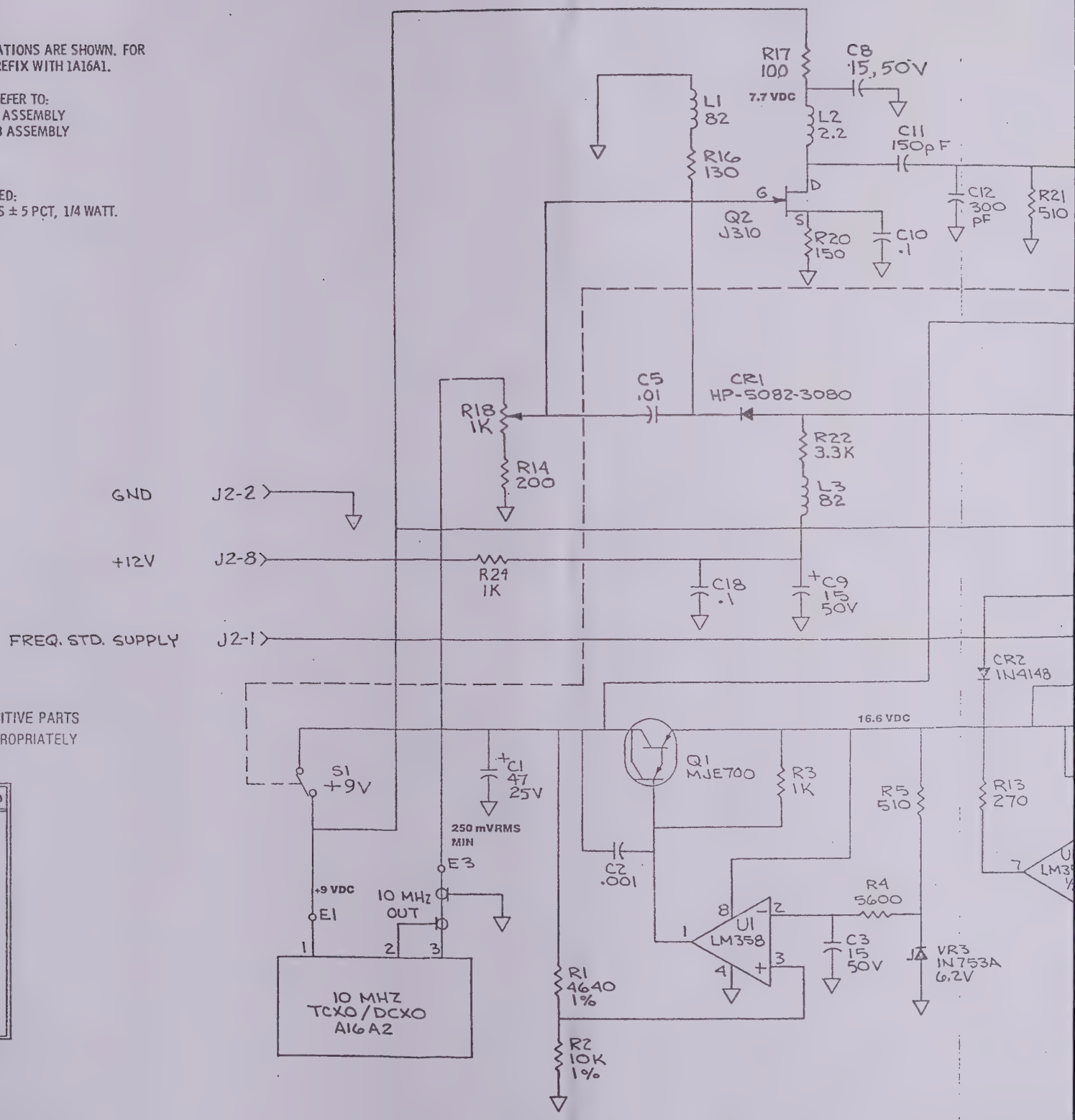
1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. FOR COMPLETE DESIGNATIONS PREFIX WITH 1A16A1.

2. FOR REFERENCE DRAWINGS REFER TO:
   A16 01-P22160E TOP ASSEMBLY
   A16A1 01-P22168E PWB ASSEMBLY
   A16A2 OCX058-P00355N
   A16A3 TCX058-P00354N

3. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTORS ARE IN OHMS ± 5 PCT, 1/4 WATT.
   ALL CAPACITORS ARE IN UF.
   ALL INDUCTORS ARE IN UH.
   ALL VOLTAGES ARE IN DC.

WARNING:
STATIC-SENSITIVE PARTS
HANDLE APPROPRIATELY

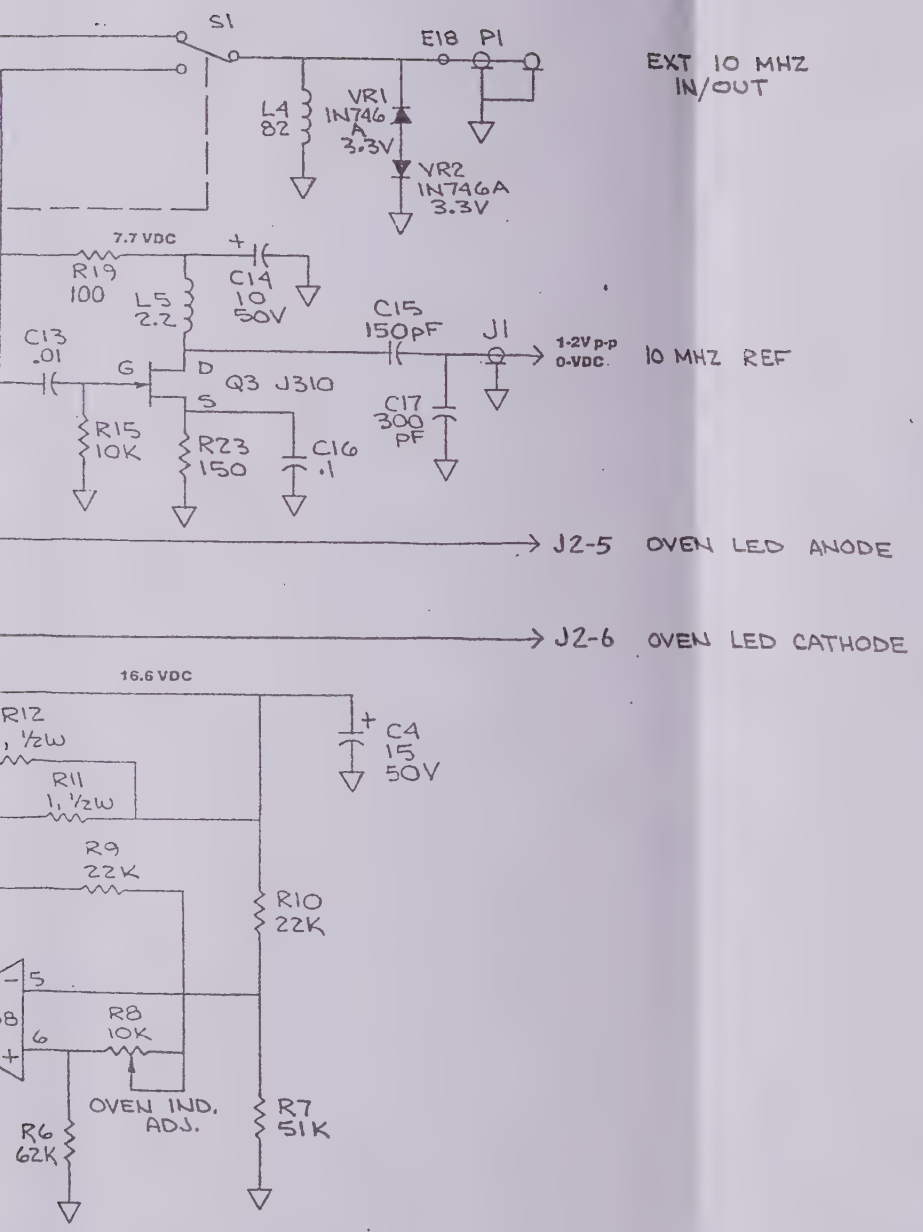
LAST USED	NOT USED
C18	C6, C7
CR2	
L5	
Q3	
R24	
U1	
VR3	
S1	



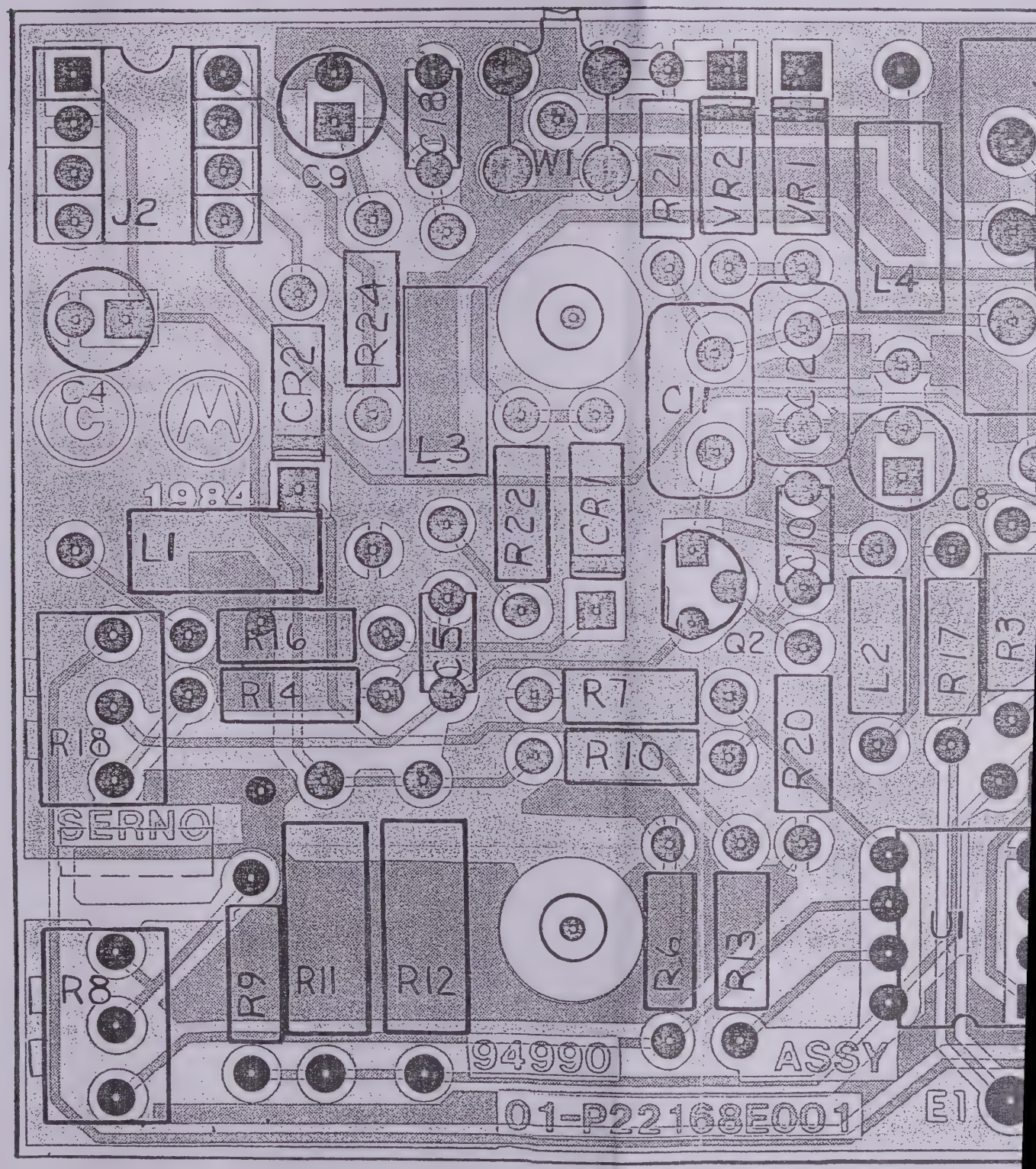
FREQUENCY – STANDARD INTERFACE BOARD (A16)

(RTL-1020A)

Figure 16-2. Schematic



36930-82

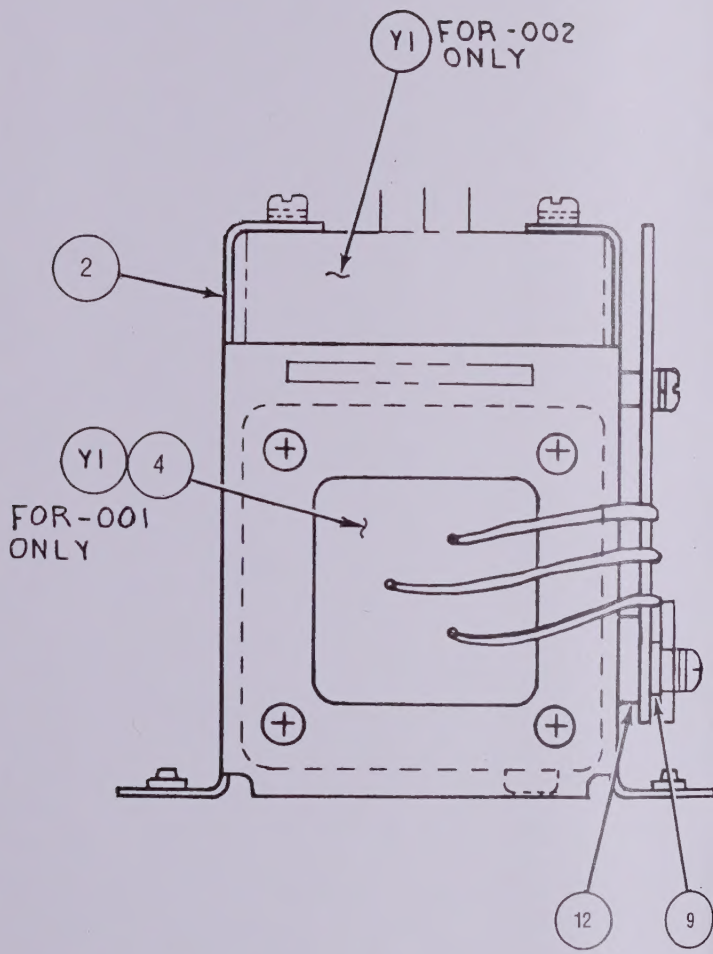


COMPONENTS AND COMPONENT SIDE TRACK SHOWN IN BLACK.
SOLDER-SIDE TRACK SHOWN IN ORANGE

FREQUENCY – STANDARD INTERFACE BOARD (A16)

(RTL-1020A)

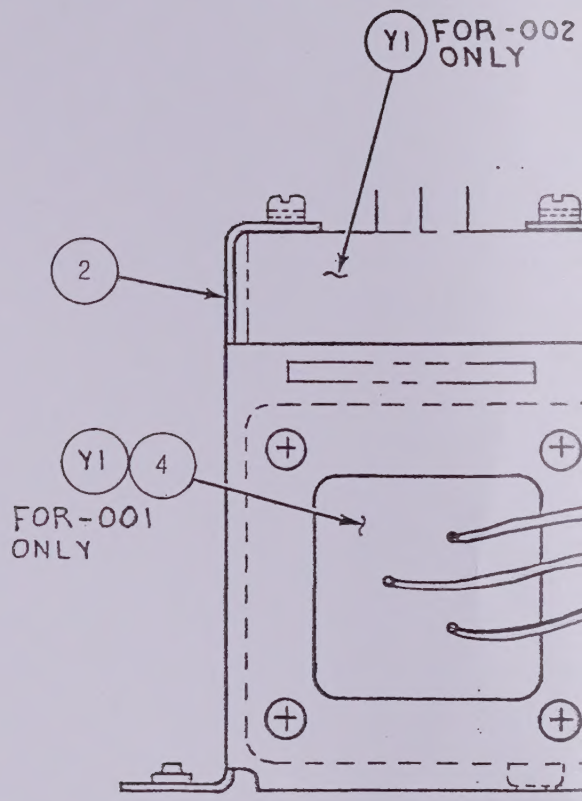
Figure 16-4. Assembly and Parts List



FREQUENCY – STANDARD INTERFACE BOARD (A16)

(RTL-1020A)

Figure 16-4. Assembly and Parts List



16-6